THESIS
ROBERT COLLEGE GRADUATE SCHOOL
BEBEK, İSTANBUL

FOR REFERENCE
NOT TO BE TAKEN FROM THIS ROOM

MAKE OR BUY DECISION

in

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Industrial Administration

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CHAPTER I

INTRODUCTION

I. Industrialization of Turkey

Turkey has entered the era of planned development within a democratic order. This attempt to achieve development aims through plans and programs is not the first experience of its kind in Turkey. The plans prepared in the early years of the Republic have yielded significant results.

Today there is a great urge for development in the Turkish community. The sad results of an unplanned economy have led to the adoption of planning as an essential way to development. The fact that the idea of planning and the State Planning Organization are embodied in the Turkish Constitution is a clear expression of this.

The realization of a 7 per cent rate of growth expressed in the

Five Year Plan depends to a large degree on the development that can take place in the manufacturing industry. For reasons outlined in the Plan, it was estimated that the average yearly rate of growth in the agricultural sector would not exceed 4.2 per cent. In the industry, on the other hand, the yearly average rate of growth will be 12.9 per cent.(1)

In order to achieve this 12.9 per cent yearly average rate of growth Turkish State Planning Department has set some principles. Some of these principles stated in the Five Year Plan are:

" f) It is thought that the measures to be taken to protect industry, and the rates of protection that will be applied in the framework of the policy of imports will be determined in conformity with development targets, and that administrative and legal provisions which favor imported products at the expense of internal production will be eliminated.

g) Imports of goods, for which internal production is satisfactory with regard to both quantity and quality, will be controlled in conformity with protection goals or will be totally prohibited.

h) Importation of competitive goods will be allowed after a suitable period of delay in order to prevent the prices of home-produced commodities from greatly exceeding world prices and to accustom domestic industry

(1) Montage Industry Regulations, Turkish Union of Chambers,

to international competition". (2)

As it is seen from the principles above, the aim of the Plan in industrialization is to encourage domestic production. But according to the experts in the Planning Organization and in the Ministry of Industry it is very difficult to develop Turkish industry quickly. The industrial development program must have several phases and pass through several stages. One of the several branches of this program covers the Regulation of the Montage Industry in Turkey.

II. Assembly Industry in Turkey:

Some industrial products or goods which are very desirable for Turkish community can not be directly produced in Turkey today. But since Turkey has very cheap labor, it would be beneficial to assemble the parts of vehicles or goods imported from foreign countries and then to try to produce some of the parts which can be produced within Turkey. So a large assembly industry has been developed in this country. This industry covers the montage of motor vehicles, refrigerators, radios, vacuum cleaners, washing machines, elevators, tape-recorders, typewriters, shaving machines

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yr. 1964, Section I, page 3

(2) Turkish Five Year Plan- Manufacturing Industry, p. 183

telephone centrals etc. But the target is to produce 100 per cent of the parts of these goods within Turkey, and in order to achieve this target gradually, each year the percentage of Turkish made parts are decided to be increased by the government.

The percentages of Turkish made parts in products assembled are shown in the table below.(3)

Products	1964(4)	1965
Tractors	20%	40%
Trucks and Minibuses	20%	40%
Buses	30%	55%
Radios	35%	50%
Shaving Machines	15%	50%
Elevators	40%	55%
Tape-recorders	20%	35%
Telephone centrals	20%	50%

Firms producing those items have to give a letter of guarantee to the government. This letter of guarantee covers an amount which is about 10 per cent of the foreign exchange that will be given to them. This money will be transferred to Turkish Central

(3) Montage Regulations, Union of Chambers, yrs. 1964-65, p.1

(4) Figures for tractors, trucks and buses excludes tires in 1964

Bank by related commercial banks. If a firm can not meet the percentage requirement set by the government and shown above, this amount will be left to the Treasury.(5)

If these percentages exceed the figures shown below, firms will be exempt from the letter of guarantee.(5)

Items	%
Tractors (excluding tires)	60%
Trucks " "	60%
Buses " "	50%
Radios	60%
Vacuum cleaners	70%
Tape-recorders	60%
Elevators	70%
Shaving machines	60%

It is very clearly seen from this information that the main target is the domestic production of these goods and machines. In the Five Year Plan there are some measures to be taken to develop the machinery industry. Among these measures we can easily extract the ones that will help Turkish industry in the way to reach this target. For example: in page 290,(6)

(5) Resmî Gazete, June 1, 1964, no: 11716

(6) Five Year Plan, Machinery Industry, p. 290.

" b) Domestic production which is satisfactory with regard to quality and price will be protected for a suitable period of time until it is able to compete with foreign goods. The necessary measures will be taken to enable domestic production to reach competitive status in a short time.

c) Cooperation should be established between the Ministry of Industry; the Technical Universities and Schools, the Chambers of Engineering, the Standards Institute and the Union of the Chambers of Commerce, Industry and Trade Exchanges with a view to providing guidance to the industry and assistance in matters of price and quality and to obtaining the necessary information

j) Components of factories and facilities which can be manufactured internally will not be imported. In order to ensure that these parts are manufactured internally, the following measures should be taken.

1. Manufacturers' association should keep informed of proposed investments and contracts and circulate this information among their members.

2. Manufacturers should bring the items they are producing or are about to produce to the notice of the circles concerned."

In the light of these measures, experts of the State Planning Organization and the Union of Chambers come together with the representatives of montage companies to organize the steps to be taken in domestic production. In those meetings the most serious problems arise in the discussion of the montage of vehicles in

Turkey.

III. Assembly of Vehicles:

In Turkish montage industry, assembly of vehicles plays a very important role.(7) Turkish Five Year Plan also has given importance to this branch and considered it in a seperate chapter in the text of the Plan. In this chapter trucks, buses and automobiles have been discussed item by item.(8)

a) Trucks: According to the Plan present truck capacity is very high in relation to cargoes to be carried by road and ruinous competition exists in this field. The liberalization of imports in this field gives rise to the expenditure of much foreign exchange. For this reason, necessary truck capacity and numbers were calculated so that the 1965 truck utilization rate would be 1.2 times that of 1960 and subsequent additions to the pool would not disturb this ratio. It was visualized that trucks would be scrapped within a maximum of twenty years. In meeting the demand for trucks imports of complete trucks will be stopped, the percentages of domestically produced components will increase annually, and will be raised by

(7) Montage Industry Regulations, Union of Chambers, 1964, p.9

(8) Five Year Plan, Montage of Vehicles, p. 308.

1967 to a level to be fixed and announced. Measures will be taken to do this in stages and prevent a decline in the utilization of truck capacity.

b) Buses: Bus needs will be met on the basis of domestic manufacture and assembly. Taking into consideration the need to develop an experienced body-work industry, it was accepted as necessary to raise the ratio of domestically produced parts and components in 1967 to a level to be fixed and announced and to adopt measures which would assure that this was done in stages.

c) Automobiles: Passenger cars are considered as luxury items. It has been agreed that only the minimum demand will be met until the percentage of domestically produced components reaches a certain level within the plan period.

Table 1 below shows the vehicle requirements forecast by State Planning Organization for the years 1965-67.(9)

Table 1: Vehicle Requirements — Thousand Units

	1965	1966	1967
Jeeps and Passenger vehicles	7.1	7.5	8.0
Trucks and Pick-ups	3.0	8.9	9.6
Buses and Minibuses	2.6	2.7	3.0

As it is seen from the table above, requirements for trucks and pick-ups show a tremendous rise in 1966. On the other hand, imports of investment goods, raw materials and auxilliary goods will be restricted. Figures are shown in the table 2.

Table 2: Imports of Investment Goods, Raw Materials and Auxiliary Goods. (Million TL)

	1965	1966	1967
Investment Goods	40.0	25.0	15.0
Raw Materials and Auxiliary Goods	165.5	175.5	170.0
Total	205.5	200.0	185.0

Table 3 shows the value added in the production and assembly of vehicles.

Table 3: Value added in Vehicle Production (Million TL)

	1963	1967
Trucks and Pick-ups	42.3	311.9
Buses and Minibuses	15.0	180.0
Jeeps	25.8	46.0
Total	83.1	537.9

Measures taken by the Plan to arrive at these figures above are:(10)

(9) Tables have been taken from the Industrial Organization Department of State Planning Organization.

(10) Five Year Plan, p. 310.

" a) In order to assure the full use of existing capacity in this field and promote the development of domestic industry, truck imports will be stopped. Imports will be allowed only if serious needs arise or to prevent monopolistic situations.

b) Passenger cars may, when necessary, be removed from the list of imports without allocation of foreign exchange.

c) Imports of light and inexpensive passenger cars will be allowed.

d) Care will be taken to ensure that the existing body work industry conform to safety standards. Imports of buses (complete with body) will be discontinued. Permission to import such buses will only be given to tourism organizations with the provision that they are operated between Turkey and foreign countries.

e) Imports of quantities of buses and automobiles which can be supplied by domestic manufacture and assembly will be discontinued.

f) Foreign exchange will be allocated to the manufacturing or assembling firms which achieve the domestic ratio to be determined in the program.

g) Imports of necessary spare parts will be permitted until domestic products can replace them.

h) Foreign exchange will be allocated to truck assembling and manufacturing firms in such a manner that they will be able to produce or assemble 2000 trucks in 1963, 2500 in 1964 and 3000 in 1965.

" i) A new system of registering goods used as security will be put into effect to facilitate credit sales.

j) Serious considerations will be given to the assembly in Turkey of trucks received as military aid and to the local production of some components."

All "Vehicles Montage Industry Regulations" have been derived from these measures. Those regulations appear in the "Regulations of Montage Industry " which is a periodical bulletin of the Union of Chambers in Turkey. Since our problem is concerned rather truck and minibus assembly, I want to deal with this item in detail.

IV. Regulations for the Firms Assembling Trucks and Minibuses:

These measures below have been set for the firms assembling trucks and minibuses (pick-ups, station wagons, panel vans etc). (11)

A. Rate of domestically produced parts:

1. The rate of domestically produced parts (including tires) will be 40% in 1965.
2. Motors will be imported in the CKD (completely knocked down) form.

B. 1. Firms which want to produce trucks by assembling domestic parts or imported parts have to have a licence approved by the Ministry of Industry.

2. They also have to have a quality approval from the Ministry of Industry.

3. Each firm assembling the parts imported from foreign countries has to assemle the brand or types of only one foreign firm.

4. Invested capital must be 8.000.000 for the existing firms and 12.000.000 for the ones to be established All firms have to raise this amount to 20.000.000 by 1967.

5. Each firm has to have at least 2 mechanical engineers and 100 workers.

6. The area of production and assembly must be at least 15.000 m^2, and 5000 m^2 of this must be in closed form.

7. Each assembly firm must have at least these necessary machines and equipment.
   - Assembly lines
   - Hydrolic lifts
   - Riveting machines
   - Portable arc welders
   - Spot welding machines

- Quality control equipment
- Compressors
- Paint heating motor and paint mixer
- Stores for parts

C. In order to be free from the letter of guarantee given to the government foreign exchange savings of a firm must exceed 60% per vehicle.(11)

The significance of these regulations above is to organize truck montage companies in order to be helpful for Turkish Industry and to realize savings in foreign currency.

Today there are about 16 companies meeting those requirements and assembling vehicles in Turkey(12), and Otosan, which is the subject of my work is one of the oldest of them.

V. Otosan

Otosan, Otomobil Sanayii A.Ş., is an assembly plant for all kinds of Ford Products, including motorcars, minibuses and trucks. The plant assembles only products of Ford Companies, but Ford itself

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(11) Montage Industry Regulations, Union of Chambers, yr.1964 p. 13,14 and yr. 1965, s.5, p.1

(12) Information received from Istanbul Chamber of Industry

has done no contribution as to the capital of the plant. The comny has contracts with American, English and German Ford companies so that they can obtain the semi-finished products from any of them. But usually the parts come from either England or Germany, and since transportation costs are too high for U.S.A. products, they hardly get anything from them except for some special spare parts or some accessories.

The construction work of the plant has begun in September 1959, and in a period of less than a year, they were able to start the production, in August 1960.

The American Ford Company has done a lot for the construction of the plant, giving valuable knowledge free of charge. A specialist from U.S.A has also supervised the construction work of the plant.

The purpose of the foundation of the plant was to gain from the assembly cost, which would otherwise go to the foreign companies. So at the beginning it was intended to be a simple assembly factory But as I mentioned before, Montage Industry Regulations which was set first in April 14, 1964 with the law no: 6/2905 and published in the Official Gazette no: 11682 has changed the situation and created some new problems for Otosan. The main principles of this law are:

1. Import lists of assembly parts will be revised with a view to protecting and encouraging domestic industry and to realiz-

ing savings in foreign currency.

2. Lists will be revised on the principle that parts of which internal production is quantitatively and qualitatively sufficient to meet internal requirements at fair prices should not be included in import lists.

3. Montage Industry Regulations also will include the list of the parts which are not to be imported in the coming years.(13)

Now the main problem is how to obtain the parts shown in those lists. In other words Otosan has either to make those parts itself or buy them from domestic industry. So after April 14, 1964, every addition to the parts lists in the Regulations has created additional make or buy decisions for the Company Management.

In the following chapters a make-buy decision has been prepared for only one part which was raised from the quota in 1965.

Information obtained to prepare this thesis has been based mainly on the interviews with the management of Otosan and domestic firms, the Union of Chambers in Ankara and the experts of the State Planning Organization. Information about the production phases of the part and some cost figures have been obtained from

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(13) Turkish Foreign Trade Bulletin, 1964, Chamber of Commerce.

Atikler Co. in İzmir and Altılar co. in Topkapi. In addition to all these the books, reports and magazines in R.C Library and R.C Mechanical Engineering Department and the publications of State Planning Department have been very helpful in preparing this work.

CHAPTER II

ANALYSIS OF THE PRESENT SITUATION

Factors Affecting " Make or Buy " Decision:

Large montage companies usually spend more than half of their income buying materials and products from other companies.

Should you make or should you buy is an eternal question faced in every phase and plan of those companies. In general it pays to make the things you are well equipped to do and to make the things you know most about. And it pays to buy things foreign to your operations.

If you are currently purchasing an item and are considering the possibility of making it instead, it will be important to note if you have capacity to do so. If you do, the incremental costs of making the item will be only the direct costs of labor and materials plus any actual net additions to other costs, such as power and

supplias. The machinery, building and supervisory and executive staff already exist, and the cost of these does not change in manufacturing the item. Therefore, you dare not use the accountant's concept of average manufacturing cost as a basis for making the decision. Only the net incremental costs need be considered. If available capacity does not exist, the net incremental costs will have to include the costs of providing the needed capacity.

In addition to capacity, economic advantage, quality considerations, delivery, special know-how, flexibility and some government regulations and restrictions are the other items to be considered in a "make or buy" decision.

To make such a decision in a Turkish Montage Company, Otosan, we have to analyze these items in the plant. In this analysis capacity is the first topic to begin with.

I. Capacity:

Capacity is the amount of units that could be produced with the buildings, machinery and equipment, capital and manpower that are available.

Otosan, being one of the oldest montage factories in Turkey, was installed in 1959 just to assemble the parts imported from the Ford Companies in U.S.A, England and Germany. According to the Production Control Department of the factory, the plant

was designed for a normal capacity of 2400 trucks and 1200 motorcars per year for single shift operations. It makes 3600 vehicles per year. But the factory has never achieved this quantity, not because of poor operational conditions, but rather due to lack of semi-finished parts. The present production of the plant is about 1700 units per year.(1) This means that the plant operates with an output of 47% of its normal capacity. In fact, this output is only for one shift. According to the information received from the Production Control Department the plant has the capability of working three shifts. In this case the factory uses only 19% of its normal capacity. The reasons of this undercapacity situation will be fully discussed later.

Now, in order to analyze the capacity of the factory in detail, we have to analyze it through several subtopics affecting the overall capacity.

A. Factory Capacity in Terms of Plant Space:

The total land belonging to the factory covers an area of 127000 m^2. The occupied parts are as follows.

Plant building	9600 m^2
Administration building	600 m^2

(1) Company's 6 months bulletin. 1965.

School building	400 m^2
Paint store	120 m^2
Gate building	100 m^2
Roads, parkings and storages	15000 m^2
Total	25820 m^2

The factory building is in the form of a single block composed of three parts:

1. Front side of the building is devoted to the administration.
2. One side of the building is used as a warehouse.
3. The other side of the building is the main production area.

Behind the factory building there is a football field belonging to the factory.

As I mentioned before, the purpose for the foundation of the plant was to gain from the assembly cost, which would otherwise go to the foreign companies; so at the beginning it was intended to be a simple assembly factory, the only part to be added here being the leaf springs which were present in the market. But today, because of the new Turkish import regulations and the industrialization policy of the government, the situation has been changed and Turkish made parts have gained importance in the assembly. Now Otosan makes 10% of a unit within its factory. So in analyzing

this subtopic we have to divide it into two groups as:

1. Assembly works,
2. Non-assembly works.

The assembly capacity of the plant is 3600 vehicles a year. The present capacity of the plant has been measured also by the Union of Chambers as 3600 vehicles a year. This measurement is made due to the application of the quota system in Turkey. Every six months assembly factories present a six months bulletin to the Union of Chambers. In this bulletin factory's production level, plant space in m^2, existing machinery, equipment and manpower and financial statements of the last period are shown(2). According to this bulletin, the present capacity of the plant is measured or estimated and the quota is shared. But Turkish Foreign Exchange resources are limited and there is a deficit in Turkish Balance of Payments, so £ 2,500,000 is used each year for assembly parts imports(3). This amount is shared by the assembly factories in Turkey in proportion to their size and capacity measured according to those bulletins. So Otosan uses what is given instead of what it needs. This is the major reason for the present undercapacity situation in the factory.

Now the factory assembles four types of products. These are:

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(2) Turkish Montage Industry Regulations, no:1, p. 5,

(3) Turkish Foreign Trade Bulletin, Union of Chambers, 1965.

- T-600 Minibuses
- TT. 75 Thames Trader trucks
- T-8000 Pick-ups
- B-600 Army buses

And according to the first six months bulletin of 1965 that the units produced in this period are:

- T-600 Minibuses	320	units
- TT. 75 Thames Trader trucks	275	"
- T-800 Pick-ups	40	"
- B-600 Army buses	35	"
Total	670	"

These figures show that the amount produced in the factory is even less than the figure given by the Production Control Department. But I was told that the figure would be greater in the second half of the year to reach 1600-1700 units.(4)

On the other hand, from the non-assembly point of view, everything works with normal capacity. This division includes the production of some internal parts such as upholstery, electrical accessories and dying. Those parts and procedures cover 10% of the whole unit. Since yearly production can be predicted at the beginning of each

(4) Those figures have been obtained by chance from the co. bulletins, and the exact figures for the whole year have

year the capacity of those sections is organized and arranged accordingly.

B. Machine Capacity:

To be able to make a unit or a part in a factory men must have the machines they need. This raises the problem of equipment selection replacement and adequate maintenance.

There are many machines and production equipment in the plant, but almost all of them are used in the assembly of parts purchased from domestic industry or imported from abroad. The existing machines in the plant are shown in the list below:(5)

Prcessing Machinery:

Kind of Machine	Made	HP	KW
Pressing Machine		2.0	1.5
Shaper	Ind. Export	2.3	1.7
Saw	Veb.	.8	.6
Spot welding (9 units)		915	675
Drilling machine	Arfona	2.3	1.7
" "	"	1.35	1.0

been disguised by the management of the factory.

(5) This table has been prepared by combining the information in the six months bulletin of the co. with the information given by the Prod. Cont. Dept.

Kind of Machine	Made	HP	KW
Drilling Machine	Arfona	1.35	1.0
Lathe	Ind. Export	3.0	2.22
"	" "	9.5	7.0
"	Ansaldo	1.5	1.1
Portable arc welder		20.0	14.8
" " "		21.0	15.6
" " "		11.0	8.15
" " "		8.15	6.0
Acid Pump	Acec	1.0	0.74
Paint heating motor	Dewilbiss	.6	0.45
Paint Mixer	Veb	1.3	0.96
Riveting machine	Louis Allis	3.0	2.22
" "	" "	3.0	2.22
Sewing Machine	Singer	.33	0.25
" " (2 units)	"	,50	0.37
" "	"	.25	0.18
Tube Cutter		.88	0.65
Tube Bender (manual)			
Staple (for wirings)		.5	0.37
2 Sound deadener processing units			
1 Wet Sand Shower unit			
2 Acid Deeks			
2 Paint Booths			
2 Dry off Ovens			
Hydraulic lift 7 tons			
" " 13 tons		140.00	103.37

Auxiliary Machinery and Equipment:

The auxiliary machines and equipment are used in processes which are not directly related to production, such as compressors, water circulation motors etc. The list of the equipment is given below, with their origins and specifications:

Kind of Machine	Made	HP	KW
Compressors	Esliher	52.	34.8
"	Lima	10.	7.4
"	General Elec.	15.	11.1
"	Atlas-Copco	7.5	5.5
"	Quincy	10.	7.4
"	Atlas-Copco	5.	3.7
Water Pump	Ruhstorf/rott	5.	3.7
Aspirator	Holwell Elec.	1.75	1.3
"	" "	7.	5.17
Burner (2 units)	Segal	.25	.18
Oven Fan		.5	.37
" "		7.5	5.55
" "		.75	.55
Fan (2 units)	Veb	2.2	1.62
"	"	2.0	1.48
Water Circulation Motor	AEG	1.0	.7
" " "	Siemens	.5	.37
6 unit Heaters			
4 " Boilers		140.00	103.5

BOĞAZİÇİ ÜNİVERSİTESİ KÜTÜPHANESİ

Factory's chief engineer, Dr. Orhan Daldal told me that it is almost impossible to make a part with the existing machines in the plant. These are all assembly machines.

Only 10% of a vehicle can be made within the plant with those machines. (These are some small accessories, upholstery and dying) But according to Turkish Montage Industry Regulations 40% of the parts of a vehicle must be Turkish Made. Some montage factories have their own machines and equipment to make some parts which are very difficult to be obtained from Turkish domestic Industry. For example: Chrysler has its own presses to form the body and doors of a vehicle. This helps it very much to reach that percentage. In order to make the body at least 400 or 500 ton hydraulic presses are needed.(6) But Otosan has only 15-20 ton presses.

C. Manpower Capacity:

Administration: According to the top management of the company, one of the most important problems of a factory or an industry, especially an expanding or growing one, is to find good and capable administrators.

In one of the publications of Turkish State Planning Organization

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(6) Information received from the Manufacturing Dept. of the plant.

there is an interesting paragraph about Turkish industrial management.(7) It is as follows:

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" Today the distinction between a capitalist or an entrepreneur and an administrator has been understood in Turkey, but it is too late now. The fruits of this understanding will be probably taken after at least 10 or 15 years with optimistic thinking. For this reason administration problem is the heart of Turkish Industrial Development. Now there is a great demand especially for industrial administrators. Subjects like cost accounting, production planning, marketing research, inventory control, financial planning etc. are not well known by most of the Turkish administrators."

This problem makes the top managers of Otosan think about, especially in expansion programs. It is very difficult to find good and experienced administrators. In the factory offices this situation can be seen clearly. Offices work at full capacity. If we take a look at the organization chart we see that some managers carry the responsibility of even two or three departments together. Beside this there is no marketing department in the company.(8)

Today the administration of Otosan consist of 44 people including 3 engineers. These 44 people are:

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(7) Machine Production Sector, St. Pl. Dept. 1964 p. 23

(8) Organization Chart was not given.

General Manager	1
Secretaries	2
Chief Engineer	1
Department Managers	4
Heads of Divisions	8
Employees (other)	28
Total	44

Salaries given to existing administrators are accepted as quite satisfactory by the top management. I couldn't get any exact figure for the salaries of each of the personnel. But I was told the average figures by the accounting department. They are the following figures:

General Manager	10 000 TL
Secretaries	2 000 "
Chief Engineer	7 000 "
Department Managers	4 500 "
Heads of Divisions	3 000 "
Employees (other)	1 200 "

The only exact figures I could get are the total monthly figures given in the company's six months bulletin. The figures are:

Total salaries paid for one month	TL/month
Management (41)	69 611
Engineers (3)	11 700

As I was told that these figures are considered as good salaries in comparing with the other firms in Turkey. But even with those salaries it is difficult to find good managers.

Technical Staff: Today Turkish engineers want to work with the Public Sector, because Private Sector does not give enough guarantee to them for their future. Especially electrical and mechanical engineers who are needed very much in montage industry prefer Public Sector. According to State Planning Organization Periodicals 75% of mechanical engineers in Turkey works with the Public institutions.(9) This situation creates trouble in private industry in forming good technical staff.

There are three engineers in Otosan. But in case of an expansion they will have trouble in finding some more qualified engineers. Especially if they go into the casting business they will need at least a good chemical engineer.

Labor: In the assembly ind. tools, jigs, fixtures and gages are the most important elements of a factory. To use them or to work with them needs a special kind of skill and technique. Beside this in every branch of industry the assembly processes and techniques are completely different from manuf. processes and techniques.

Today there are 217 workers in the factory and about 90% of them

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(9) Manufacture of Machinery. SPO. May 24, 1964. p.23

are used in assembly processes. So in order to make a part within the plant some additional skilled and experienced workers are needed.

In almost all factories in Turkey "on the job" training is applied. This method can work for the assembly workers in the plant now, but since the "making" process is a new subject for the plant and there are very few workers specialized in that field, the workers hired for this purpose must be all skilled and experienced.

In Turkey, skilled workers are the ones who have worked on a job since their childhood. Although their number is limited Otosan can find such workers easily, because it pays well enough for the. For example: Although the minimum payment is 1.49 TL/hour in the industry, the workers in Otosan are paid minimum 2.00 TL/hour. In addition to that 50% additional primium is paid for overtime. According to the accounting department of the factory social benefits given to the workers amount to 60% of the wages given to them. Total wages paid for one month are: (co. bulletins)

Workers (direct)	217	181 275 TL
" (indirect)	80	56 264 TL
Total	297	247 539 TL

The factory has accepted an interesting principle of not employing anybody older than 35. At the beginning they applied this as well, but now they keep their old skilled workers and do not accept new

applicants older than 35.

D. Energy:

1. Power Supply and Distributions: The factory needs 500 kw/hrs electricity. 425 kw/hrs of this is needed for regular working force, remaining 75 kw/hrs is used for lighting purposes.

The factory does not have its power plant. Power is supplied by "ÇATALAĞZI" Thermoelectric power plant. The electric current reaches the factory at a voltage of 1000 volts. then it is stepped down to 380 volts in the transformer room. From here the power is distributed into the plant, and it is further stepped down by transformers whenever necessary.

An illumination line traverses the factory throughout in every row of columns. Due to high precision work being done great emphasis is given to illumination. They have constructed a network of fluorescent lamps both in the production area and the offices.

Another transmission line is used for the machinery. This goes through several transmission boxes and is distributed to each machine.

2. Water Supply and Distribution: Water is provided by two wells. Pumps, placed near the wells, pump the water up to the main reservoir which is at 250 tons capacity. From the water-tank two lines go out. One of them supplies water for operations and the other one is used for fire extinguishing purposes.

3. Heating and Air-conditioning: Otosan has two different systems for heating purposes. The production area is heated by means of six unit heaters which are distributed within the plant. In these units heavy fuel oil is used. The heat produced by combustion is blown out by electrical fans.

B. Capital:

Otosan is a business corporation having 10 000 000 worth common stock. I was told that 55% of this common stock is owned by Mr. Vehbi Koç and the rest is owned by 120 shareholders. It is an element of Koç Holding.

The plant assembles only the products of Ford Motor Co. but Ford itself has made no contribution to the capital of the plant.

Top management of the factory does not face the capital problem as an important one. For example: Mr. Erdoğan Yönül, head of the Production Control Department, told me that capital is the least important subject beside administrational, technological and legal

CHAPTER III

MAKE OR BUY DECISION

I. Selection of the Part:

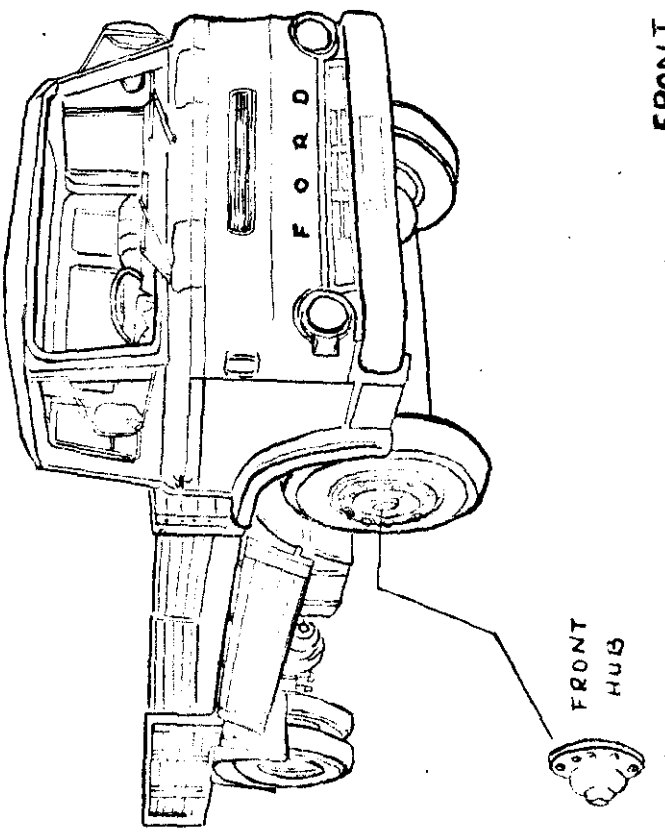
After a long discussion of the situation with the plant's chief engineer Dr. Orhan Daldal, I was given the part to be studied in this decision. This was the "Hub".

Hub is the central part of a wheel. It comes together with drum and forms the main structure of the wheel. It is made out of cast steel, and has a code number which is 2000 E - 1106 K in the assembly. (Figures 1 and 2)

As I mentioned in the preceding chapters, hub is one of the parts to be produced within Turkey. Now our problem arises . Should it be an Otosan production or should it be bought from the domestic industry? Before answering this question we have to exam-

Figure 1

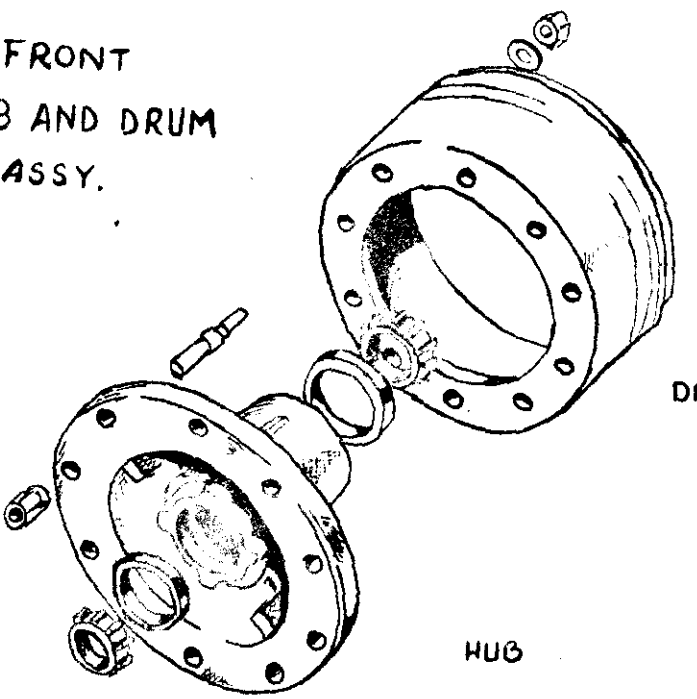
FRONT HUB of a FORD TRUCK



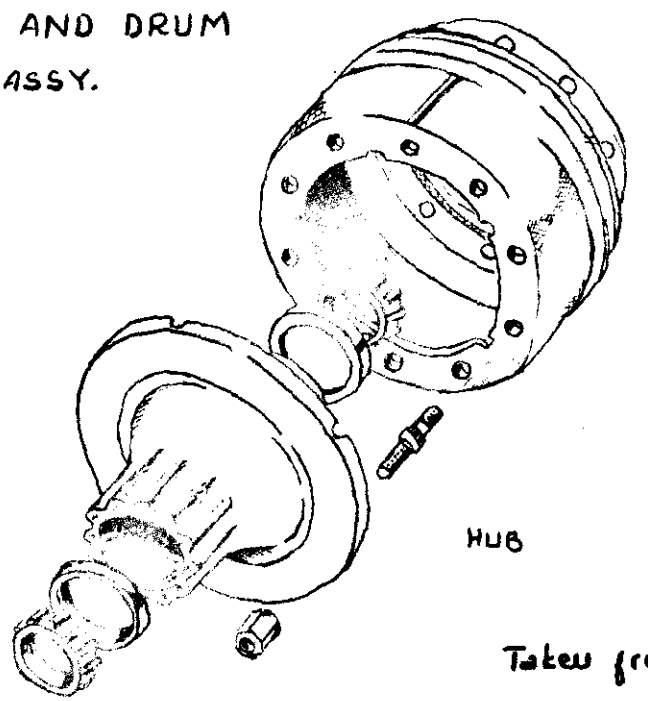
Taken from: D. series 1965
Parts List with illustr. Fo Mo Co. p. 30

Figure 2

FRONT
HUB AND DRUM
ASSY.



REAR
HUB AND DRUM
ASSY.



Taken from. A. series 1961
Parts list with illustr. FoMoCo. p 31

ine the production phases of this part.

II. Technical Aspects and Requirements in Production of a Hub: (1)

We can classify the manufacturing processes of a hub into three groups which have the following basic purposes:

A. Shaping or forming the metal - Metal Forming.
B. Heat treatment to change physical properties.
C. Machining parts to specified dimensions - Planing, Drilling.

A. Metal Forming:

Sand Casting: Sand casting remains the most versatile of metal forming processes since casting of virtually any size and shape can be produced.

The production of sand casting involves essentially:

1. Producing a pattern which is used over and over to

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(1) Information obtained from:
a. Prof. A.Halet Taşpınar, classnotes- Mech. Engg. Dept. Robert College.
b. Modern Production Management, Elwood S.Buffa, John Wiley and Sons, Inc.1961.
c. Demonstrations performed in Altılar and Atikler co.Izmir

make molds of a given shape.

2. Making a sand mold from the pattern.
3. Pouring molten metal of the desired alloy in the mold. The poured molds are broken open after the metal has frozen and, finally, the castings are cleaned up. In casting hub steel will be molten and poured.

The pattern is commonly made of wood by skilled pattern makers using common hand and power wood-working tools. (According to the domestic manufacturers, the graduates of vocational schools are very available for this purpose). When the quantity of castings to be made from the pattern is large, patterns are made from metal, usually aliminium. The pattern maker does not make an exact replica of the finished part but must make allowances for metal shrinkage, draft and finish. The shrinkage allowances depend upon the metal to be poured. For example: Shrinkage allowance for steel is 1/4 inch per foot. In order that the pattern be drawn from the sand mold without damaging it, a slight taper is required. This taper allowance is called draft. Finally, excess metal is normally left to be cut off during the finishing operations to produce the final dimensions. This allowance varies with the size and shape of the pattern but would be about 1/8 inch for the average size casting.

Given the pattern, the sand mold preparation must be done carefully to give a mold of the correct density. The mold must allow gasses formed in pouring to escape or they will form as bubbles

in the casting itself, producing defects. Of course, if the mold is packed too loosely it may not hold together while being handled and poured. Of great importance in achieving a good mold is the composition and condition of the sand itself. (Figure 3).

Sand Casting Machine: Machinery is usually used in the molding operation to pack the sand in the mold. These machines jolt, squeeze, or throw the sand to achieve the required density for a good mold.

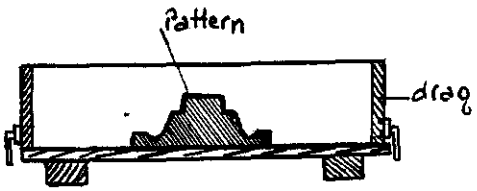
After casting procedures are completed a rough form of the hub is obtained. Now heat treatment is necessary to soften the part.

B. Heat Treatment:

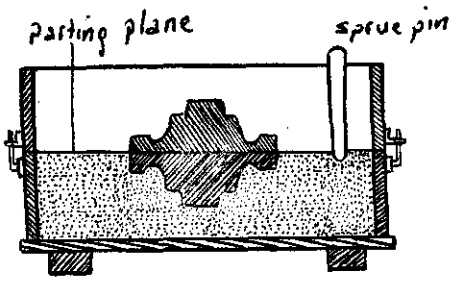
The final physical properties of metal specified by the design engineer are not always consistent with our ability to process the metal; that is, the functional demands of the part in use may require a very hard material which would be difficult or impossible to cut. Fortunately, by processes of controlled heating and cooling of the solid-state metal, the physical properties of the metal can be altered considerably at almost any point in the fabrication of the part, so that machining can take place while the metal is in the most machinable state, the final properties being produced at the time desired.

The controlling of properties by heating and cooling is called

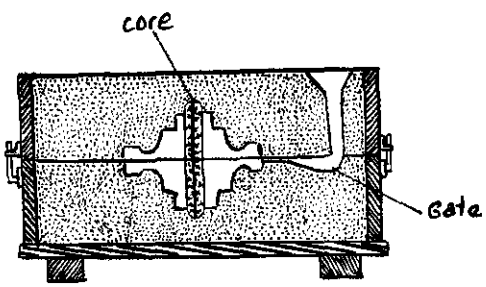
Figure III.



A. Pattern on molding board
Ready to ram up drag



B. Drag rolled over and pattern
assembled ready to ram cope



C. Mold complete with dry
sand core in place.

(Taken from Modern Production Management, Elwood S.Buffa, John Wiley and Sons Inc. 1961, p. 206.)

heat treatment. It is a part of broader technology of metallurgy, as well as the technology of metal products production. A full knowledge of heat treatment requires a knowledge of metals chemistry that includes the effects of alloying elements on physical properties, as well as the effects of controlled heating and cooling processes on physical properties.

Hub is made of cast steel. Steel has a crystalline structure and the size of these crystals or grains is very important in determining properties of hardness and strength in steel. The most important factor in determining what will be the size of these grains is the heat treatment received by the steel. It has been common knowledge among shop and metallurgical people for many years that fine-grained steels are tougher, more ductile, and have a lesser tendency toward cracking and distortion during heat treatment. On the other hand, coarse grained steels have better machinability.(2) Machinability is a general term expressing the relative ease with which a material can be cut.

There are generally two heat-treating processes. These are:

1. Hardening
2. Annealing or softening

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(2) Modern Production Management, Elwood S.Buffa, John Wiley and Sons Inc. 1961, p. 242.

In production of hub only annealing or softening process is necessary.

Annealing: Annealing processes are used to soften hard steels in order to improve machinability, or in order to cold work the steel. The process is one of raising the temperature to a level dependent on the steel composition and holding it at that level until the temperature is uniform throughout the piece. According to the given by the designs of the part, this temperature will be 1750°F. It is then cooled slowly. This is known as full annealing, since it removes all trace of the previous grain structure, refines the structure, and relieves internal stresses and trapped gasses which may have occurred during casting. Heating time is considerable, taking about 45 minutes per inch of thickness. Cooling rates are very slow. To obtain maximum softness, the parts may be allowed to cool down with the furnace. Partial anneals are also done. Normalizing is essentially with a room temperature air cooling. It is the most common way in hub production.

After heat treatment (annealing), the parts have to be worked on. The following procedure is turning.

C. Machining Parts to Specified Dimensions:

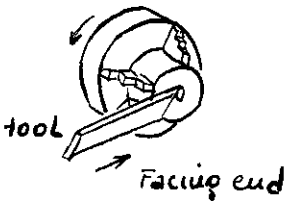
Lathe: A lathe produces cylindirical surfaces, holes, threads,

(3) Designs obtained from Otosan, Prepared by Ford Motor Co.

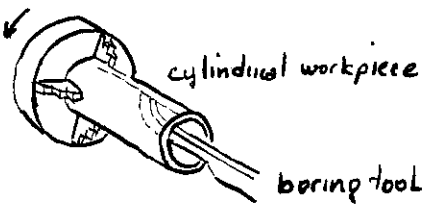
plain surfaces on the face of the work, etc. But different types of lathes are adapted to different production rates. The engine lathe might be used if one or a few parts are to be produced, but if several thousand parts are required, some type of automatic lathe would probably be considered. In this proliferation of machine types, we are not including special purpose machines. The automatic lathe would still be considered a general purpose machine since it can be set up to run various kinds of materials and parts in its general capability class.

In all these turning operations metal is removed from the part in small chips by the cutting action of a tool. The cutting action is accomplished by either a rotating or reciprocating action of the relative to the part. In combination with this motion either the tool or the work must "feed" to produce a continuous cutting action over an entire surface.

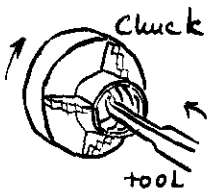
The engine lathe is designed so that parts can be mounted between the centers of the spindle and the tailstock and rotated at a selected speed. Also, by the use of a "chuck" attached to the spindle, the part may be mounted only on the spindle end and the tailstock left free to hold a tool, such as a drill. The tool post is mounted on a slide which can feed the tool either along the axis of the machine or at right angles to the axis of the machine. The engine lathe is a very versatile machine tool and with the many attachments that can be used with it, its functional capability is almost unlimited. (Figure 4)



Facing off End of Piece



Boring



Cutting Threads on the inside diameter

Figure 4.

The turret lathe has been designed so that much of the skill required for ordinary engine lathe work has been transferred to the machine. Once the turret lathe has been set up, a machine operator ca be trained to reproduce parts within tolerance limits and at an increased production rate. To set up the turret lathe, however, requires considerable time and job knowledge, so that its field is for higher volumes than the engine lathe.

Automatic lathes go one or two steps further and provide automatic mechanical means of indexing and feeding the tools to the work. At this stage, the operator is required mainly to lead and unload the machine. When magazine or bar feeds are employed, the machine is truly automatic and one operator can usually service several machines,since his duties are largely of a surveillance nature with periodic loading of magazines, etc. The automatic lathes recuire considerable time for set up by highly skilled worker, but of course, the production rates are very high so that unit direct labor is low. The field of application is in mass production.

According to Prof. A.Halet Taşpınar in R.C., domestic producers and the demonstration in Atikler co., turning procedure takes about 20 minutes in working on a hub.

After turning procedures are completed, planed hub must be drilled. So drilling and boring machines are needed.

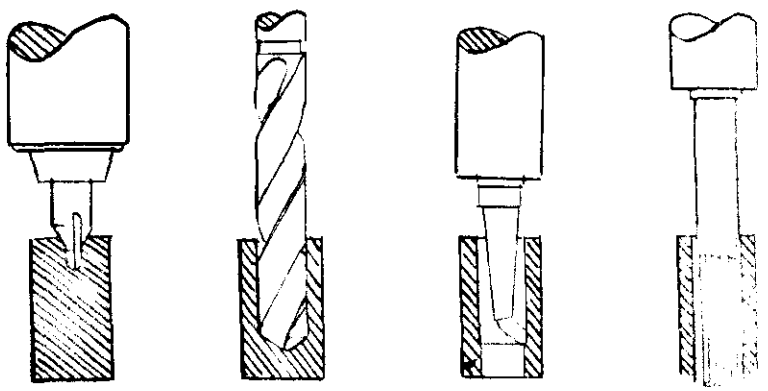
Drilling and Boring Machines: Drilling and boring machines are

used mainly to produce round holes. The drill press is the simplest of machine tools.(Appendix) Holes produced with the drill press are ordinarily somewhat out-of-round and, in addition, the accurate location of the hole is difficult because of the blunt point of the drill. Therefore, to produce accurate holes in terms of both location and size, it is necessary to start the hole with a centering and center sinking operation, followed by a drilling operation, which should produce an undersized hole to allow for truing the hole later. To produce the final hole dimension, the drilled hole can be bored or reamed or both. (Figure 5). Alternately a drill jig may be used which eliminates the need for centering and boring operations. The jig holds and guides so that the hole locations are accurate. The guiding action of the jig eliminates the need for boring.

Gang drills are two or more drill presses mounted on the same base, allowing a sequence of operations to be set up. For example: A 4 gang drill could easily be set up to perform the four basic operations of centering, drilling, boring and reaming. Multiple spindle drills make it possible to drill several holes simultaneously. Those are for higher production rates and are often designed as single purpose machines.

Drilling operations of a hub take 15 minutes with one spindle general-purpose machines and 4-5 minutes with multiple spindle special-purpose machines.

Figure V



a. Centering

b. Drilling

c. Truing hole with boring cutter

d. Final sizing with reamer

Procedure for producing accurate holes (taken from Modern Prod. Management Elwood S. Buffa p. 233.)

After turning and drilling, the part becomes ready for assembly. Machined surfaces of the part must be suitably protected against corrosion during shipping and storage.

III. Company Management's View:

According to the information received from the Production Control Department and the Plant's Chief Engineer, Dr. Orhan Daldal, company management's view in this problem can be summarized as:

A. The level of production will be 10 trucks a day in the coming years. If we accept that the plant works five full days in a week, that means the level of production will be about 2500 trucks a year. Four hubs needed in a truck. (One hub for each wheel). That means 10 000 hubs are needed in a year.

B. In machine selection, there are two types of machines to be considered. These are:

1. General-Purpose Machines: These machines are those that have general use of capability. They find their field of application in an atmosphere of low volume and instability of part of product design or of market, that is where conditions demand flexibility.

2. Special-Purpose Machines: They commonly have evolved

from their general-purpose counterparts as the volume of a particular part or product increased. By specializing dezigns, higher production rates can be achieved.

Production of roughly 10 000 hubs a year, (40 hubs a day) is considered rather as low volume by the company management.

C. There are mainly 4 different strategies to be considered by the management of the company in this decision. (They have been given by Mr. Erdoğan Gönül, Head of the Production Control Department.) These strategies are:

1. Buying the part (complete) from the domestic industry.
2. Buying it as casted steel (rough) and machining and completing it in the plant.
3. Importing it from England or Germany.
4. Making it in the plant_- Otosan production. (Complete).

These strategies will be discussed in detail in the next sub-topic.

D. In considering these strategies from the company management's point of view, we can conclude that the situation of the plant is not available for casting business, because:

1. To perform this job, an area of at least 200 m^2 is needed. This is for a founry, stores for coal and sand, and annealing furnace. Company's management thinks that

it is very difficult to find this space in the plant.

2. According to them, casting processes are very dissimilar to the assembly processes.

3. Now the company tries to establish some machinery with which they will be able to produce the body of the car within the plant. This will open the way towards the production of vehicles in larger quantities. In fact, the company had this in mind at the very beginning, so that the foundations of the factory building have been made strong enough to permit the installation of large pressing machinery. So, the top management of the factory wants to give priority to this project.

IV. Descriptive Analysis of the Factors:

Under this topic I want to analyze the factors affecting make or buy decision with those strategies stated by the management of the company. (Matrix)

A. Capacity:

Volume: As I mentioned in the second chapter, the capacity of the plant is 3600 vehicles per year. But this quantity has not been achieved due to the quota restrictions. The only way to in-

crease the output is to increase the percentage of Turkish made parts in a vehicle. According to Dr. Orhan Baldal, the aim of the plant is to assemble 2500 vehicles a year, (10 vehicles a day) in the coming years.

If Otosan uses Turkish made hubs, (either made in the factory or bought from the domestic industry), in the assembly, it will help them to some extent to achieve the desired level of output. But the import of this part will restrict the chance to obtain other semi-finished parts from foreign countries. In other words, Otosan's level of production will increase in the proportion of the domestic parts used in the assembly of a vehicle.

Machines: If Otosan makes 'the hub' within the plant, some machinery will be necessary. According to the information given by the engineering department, existing lathes and drilling machines are in small size. They also work with full capacity. So there must be at least 2 new lathes and 2 drilling machines to machine the parts. Because:

Turning procedure of a part takes 20 minutes,
40 hubs a day, 40 x 20 : 800 minutes a day
800 ÷ 60 : 13.3 hrs/day. 1 lathe works 8 hours a day

Drilling procedure takes 15-18 minutes per hub
40 x 18 : 720 minutes a day, 720 ÷ 60 : 12 hours.
So 2 lathes, 2 drilling machines and 2 drill jigs are needed.

In case of making the complete part within the plant, a foundry, mold boxes, an annealing furnace are necessary in addition to the lathes and drilling machines.

Strategies III and IV do not have any additional requirements.

Manpower: According to the information received from the technical managers of Otosan, Atikler and Altılar companies, the additional manpower required in the production of 40 hubs a day is the following:

1 Metallurgical engineer
1 Production Control Foreman
1 Clerk (for purchasing, controlling, recording etc.)

Workers:

1 for Modelling
2 " Casting
1 " Annealing
2 " Lathe (1 for each lathe)
2 " Drilling
1 " General

Machining the part requires 2 workers for lathe, 2 for drilling and 1 general worker.

Energy: In casting and annealing, the energy required can be

obtained from coal. In machining:

2 lathes (10 HP each)	8 x 10 x 2 =	160 kw a day
2 drill mach. (2 HP)	8 x 2 x 2 =	32 kw "
Total		192 kw required a day

Capital: Interest rate given to the credits is 12.6 %.(4)

Cash outlay in otosan production:

Annealing furnace	60 000 TL
2 Lathes (75 000 each)	150 000 TL
2 Drilling mach.	20 000 TL
2 Drill jigs	4 000 TL

Annealing furnace is excluded in the second strategy. (Machining the parts in the plant.)

According to the managers of the plant, the capital required can be supplied internally.

B. Quality:

According to the technical staff of Otosan, the quality of the hubs produced in the plant would be better than those produced by the domestic firms, because they have several advantages, such as:

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(4) Company Balance Sheet, 1965.

1. They have better technical know-how and they know about the modern production methods.
2. They can obtain the necessary brochures and prospectuses from Ford Motor Co.
3. They can send their foremen to foreign countries and train them in short courses there.
4. They can find skilled workers easily, because they pay them well.

The quality of the parts bought from domestic firms is not so good because these firms have:

1. Lack of quality control and testing.
2. Lack of skilled labor.
3. Lack of technical know-how and modern methods.

Hubs imported from England have all the quality standards and specifications stated by Ford Motor Company.

C. Inconsistent Delivery:

As I mentioned before, this problem is the result of poor technical methods, irregular orders, lack of energy, equipment and capital in the domestic industry. So inconsistent delivery is one of the main troubles in montage industry.

D. Price:

In the domestic market the prices of a hub varies between 175 and 225 TL. Today Atikler co. in Izmir makes hubs and sells them to Otosan at a price of 175-200 TL each. (Front hubs 175 TL and rear hubs 200 TL).

If Otosan produces this part in the plant, the cost of a part comes cheaper, because only the incremental costs are considered here. Cost calculations will be shown in the next topic.

Import prices are higher than domestic prices. The price of an imported hub varies between 350-425 TL. Their costs to Otosan are about 250-325 TL each.

For example: Front hub - (7.5 tons) 351.31 TL
Rear " " 421.20 TL (5)

According to the information received from Motor Ticaret Co., the reason of these high prices is the custom tax taken by the government.

E. Flexibility:

Otosan's top-management thinks that the establishment of a foundry

---

(5) The price list of Ford Parts - Motor Ticaret Co. Kocdiyekoy.

disturbs company's flexibility, because casting is a different branch in industry and it rarely goes together with the assembly businesss.

Machining of the rough parts bought from local industry requires only some new lathes and drilling machines, which are very similar to the existing machines in the factory. So in this case, the situation does not change from the flexibility point of view.

F. Import Restrictions:

According to the "Montage Industry Regulations - Union of Chambers 1965", hub is one of the parts which were removed from the import list. In other words, the import of hub has been restricted by the government.

V. Cost Structure:

Most businessmen would agree that the major criterion for decision making in the make-buy area is cost. If a part can be bought cheaper than it can be made, buy it. Every situation in this analysis must be analyzed in terms of the incremental costs involved.

First of all, if we analyze the cost structure in terms of standard costs, we have to consider mainly three items. These are:

1. Material
2. Labor
3. Overhead.

Other points to be considered:

a. Since the management does not want to establish a found strategy II will be calculated.

b. Level of production : 10 000 hubs a year.
or : 5 000 front hubs
5 000 rear hubs

c. Weights(6): Front hub: 19.100 kg
Rear hub : 22.040 kg

d. Material: Cast steel, 1 kg : 8.5 TL

e. Labor: Turning takes 20 minutes per hub
A lathe worker takes 40 TL a day(7), (5 TL/hr)
Drilling takes 15 minutes per hub
A drilling worker takes 30 TL a day, (3.75 TL/hr)

f. Social costs are 60% of the labor costs.(8)

g. Overhead is calculated as 150% of the labor costs.

---

(7) Information received from the accounting department of the factory.

(8) This includes lunch, transportation, insurance, compen. etc.

Cost calculations:

Front Hub:

Material:

19.100 x 8.5 — 162.35 TL

Labor:

Lathe: 1/3 hr. 5 x 1/3 : 1.67

Drill. 1/4 hr. 3.75x1/4 : .95

Total labor cost 2.62

Social costs 60% 1.57

Total labor and social costs 4.19

Overhead:

150% of labor cost [illegible]

Total cost per unit (front hub) [illegible]

Rear Hub:

Material:

22.040 x 8.5 — 187.34 TL

Labor:

Lathe: 5 x 1/3 : 1.67 TL

Drill: 3.75x 1/4 : .95

2.62 TL

Social costs 60% 1.57

Total 4.19

Overhead: 150% of labor cost [illegible]

Total cost per unit [illegible]

Money saved per unit:

Front hub: 175.00 - 170.46 : 4.54 TL

Rear hub : 200.00 - 195.45 : 4.55 TL

VI. Break-Even Analysis:

The breakeven concept is an important one for analysis of many company-wide problems. It shows management what will happen to the profits as a result of proposed courses of action.

In our breakeven analysis we have to consider two types of costs which affect the decision. These are:

1. Semi-variable costs
2. Variable costs

Semi-variable Costs:

1 lathe for	6000	units/year
1 drilling machine	8000	" "
1 drill jig "	8000	" "
1 indirect worker	10000	" "

An indirect worker is paid 16 TL a day.

Table shows the semi-variable costs required in different levels of production.

Break-Even Analysis - Semi-variable costs.

Production level	Machinery + eqpt. req.	Depreciation %8	Indirect worker.	Total cost/yr.
0 - 6000	1 lathe + 1 drill + jig. 75000 + 10000 + 2000	6960	5760	12720
6000 - 8000	2 lathes + 1 drill + jig	12960	5760	18720
8000 - 10000	2 lathes + 2 drills + 2 jigs	13920	5760	19680
10000 - 12000	" " "	13920	11520	25440
12000 - 16000	3 " " "	19920	11520	31440
16000 - 18000	3 " 3 " 3 "	20880	11520	32400

Price of a hub (complete): Front : 175.00 TL

Rear : 200.00 TL

A pair of hubs: 375.00 TL

Price of a hub (rough) Front : 162.36 TL

Rear : 187.35 TL

A pair of hubs(unmachined): 349.71 TL

Difference between machined and rough:

375.00 - 349.71 : 25.29 (for each pair)

Variable Costs: Labor (incl. soc. costs) 4.72 TL

Electricity (.5 TL/kw) .25 TL

Total 5.07 TL

5.07 x 2 : 10.14 TL

Break-Even Point:

25.29 x : 6960 + 5760 + 10.14 x

15.23 x : 12720

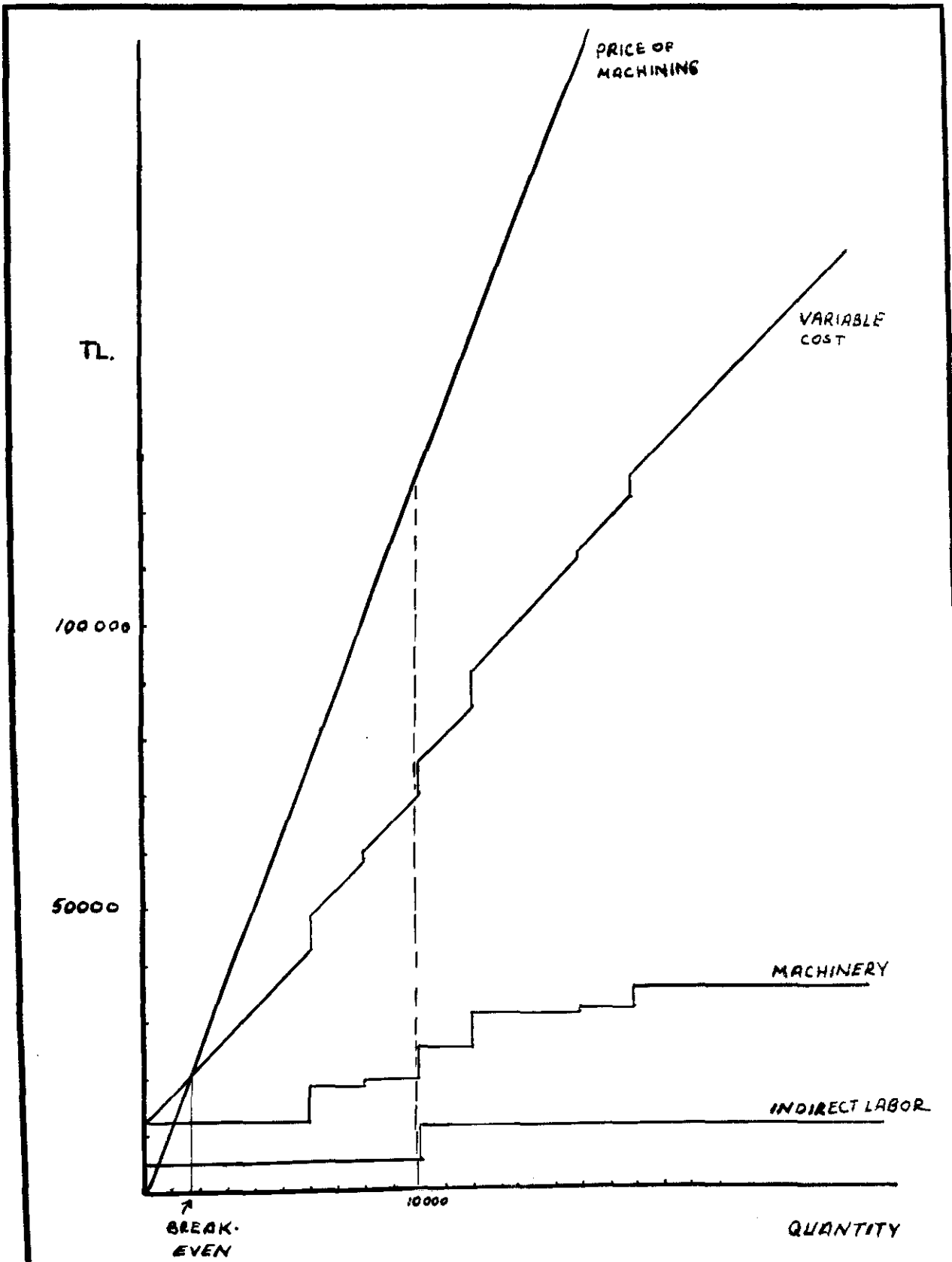
x : 835 pairs or 1670 units

Production level: 10000 units or 5000 pairs:

25.29 (5000) : 12720 + 5760 + 10.14 (5000) ..

126 450 : 12680 + 50600 - x

x : 50 470 TL



BREAK-EVEN ANALYSIS

VII. Profitability Index:

Profitability Index is the predicted interest rate of return after taxes. It is mainly concerned with the concept of "Time Value of Money". The concept called " Time Value of Money" is the concept or tool which makes it possible to evaluate in terms of present worth and rank types of projects.

The profitability index has certain limitations as related to [illegible] and forecasting, which can not be factored into the system, yet these should be evaluated and weighed before any capital commitments are made.

The "Profitability Index" system has been developed for the purpose of evaluating capital expenditures-the future earnings of the Company-and is intended for this use and not for evaluating the efficiency of the division as illustrated by the rate of return accounting method, which is insensitive to variations in the time pattern of investment outlays and earnings. The system is an excellent tool for management to determine the course of future earnings since it can help to direct the flow of capital into the projects making the highest rate of return.(9)

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(9) Request for Investment Expenditure-Procedure Manual, Whirlpool Corporation, St. Paul Division. (Obtained from Prof. Metin Göker)

This system has been used first by Dupont Company which is one of the most profitable companies in the States.

Generally, the investment projects having Profitability Index over 20% are accepted.(10) The application of this method has been shown in the table and the graph II.

Capital Equipment:

2 Lathes	(75000 TL each)	150 000 TL
2 Drills	(10 000 TL each)	20 000
2 Drill jigs	(2000 TL each)	4 000
	Total	174 000 TL

Variable cost (a pair)	10.060 TL
Ind. Labor 5760/5000	1.152
	11.212 TL

25.29 (5000) : 11.212(5000) x

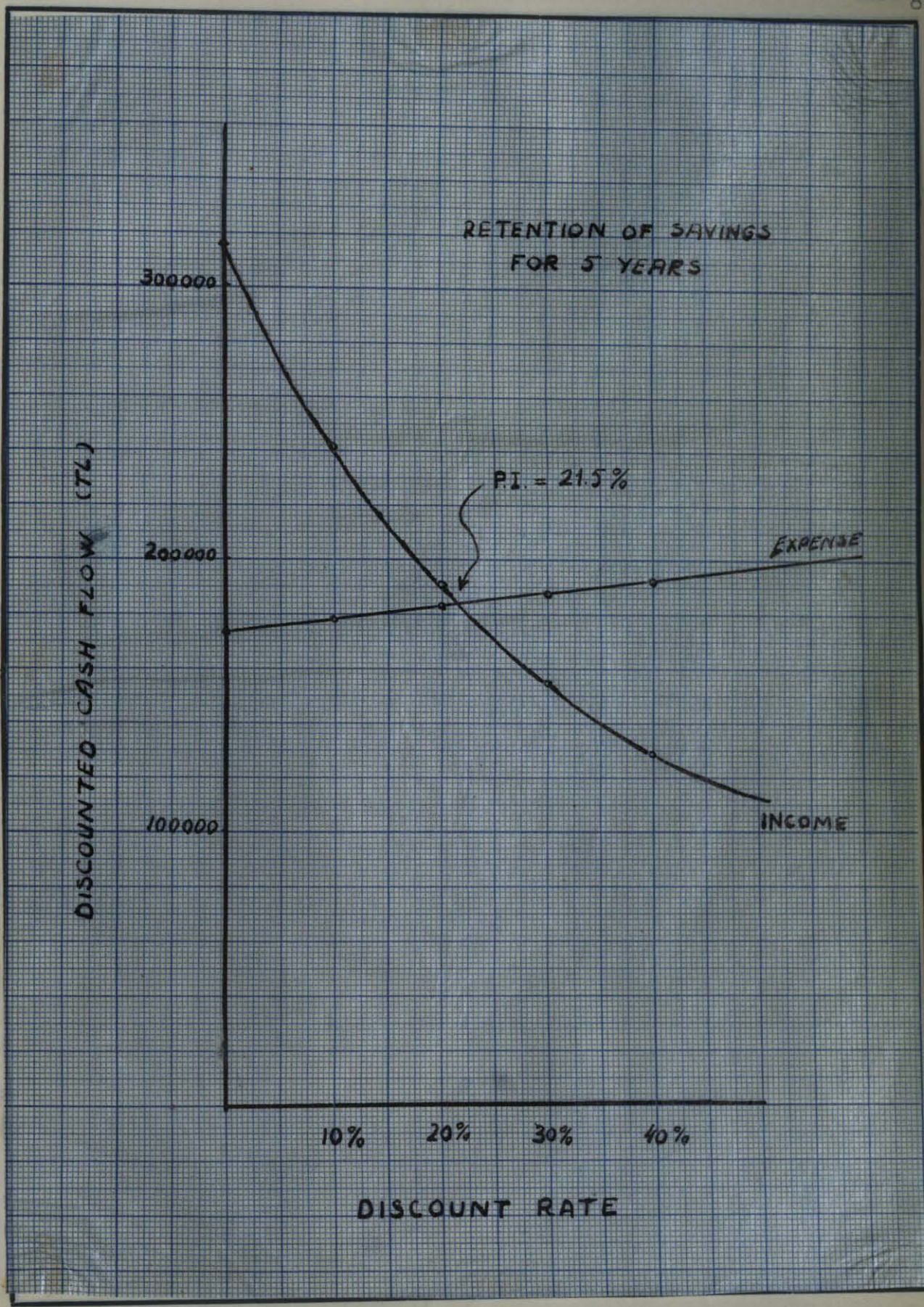
Income before depr. x : 70 600

(10) Request for Investment Expenditure, Procedure Manual, Whirpool Corp. St. Paul Division. Operation Analysis Dept. January 1962.

RETENTION OF SAVINGS FOR 5 YEARS

PROFITABILITY INDEX = 21.5 %

1	2	3	4	5	6	7	FROM J.C. GREGORY'S INTEREST TABLES (CONT. COMPOUNDING)							
YRS.	EXP. SAVING OR INCOME	DEPR. 8%	REM. BOOK VALUE (2-3)	SAVINGS LESS DEPR (2-3)	NET PROFIT AFTER TAX (20% .80 (5)	CASH FLOW (6+3)	DISCOUNTED at 10%		DISCOUNTED at 20%		DISCOUNTED at 30%		DISCOUNTED at 40%	
							FACTOR	FACTOR x COLUMN 7	FACTOR	FACTOR x COL. 7	FACTOR	FACTOR x COL. 7	FACTOR	FACTOR x COL. 7
CAP.	174000					174000								
TOTAL	174000					174000	1.0253	178402	1.0513	182926	1.0779	187555	1.1052	192305
0-1	70390	13920	160080	56470	45176	59096	.952	56259	.906	53541	.864	51059	.824	48695
1-2	70390	13920	146160	56470	45176	59096	.861	50882	.742	43849	.640	37821	.553	32680
2-3	70390	13920	132240	56470	45176	59096	.779	46036	.608	35930	.474	28012	.370	21866
3-4	70390	13920	118320	56470	45176	59096	.705	41663	.497	29371	.351	20743	.248	14656
4-5	70390	13920	104400	56470	45176	59096	.638	37703	.407	24052	.260	15365	.166	9810
5-6		13920	90980	-13920	-11136	2784	.577	1606	.333	927	.193	537	.112	312
6-7		13920	76560	-13920	-11136	2784	.522	1453	.273	760	.143	398	.075	209
7-8		13920	62640	-13920	-11136	2784	.473	1317	.223	621	.106	295	.050	139
8-9		13920	48720	-13920	-11136	2784	.428	1192	.183	509	.078	217	.034	95
9-10		13920	34800	-13920	-11136	2784	.387	1077	.150	418	.058	161	0023	64
10-11		13920	20880	-13920	-11136	2784	.350	974	.123	343	.043	120	.015	42
11-12		13920	6960	-13920	-11136	2784	.317	883	.100	278	.032	89	.010	28
12-13		6960	0	-6960	-5568	1392	.287	400	.082	114	.024	33	.007	19
13-14							.259		.067		.017		.005	
14-15							.235		.055		.013		.003	
TOTALS		174000				316360		241445		190713		154850		128615


RETENTION OF SAVINGS
FOR 5 YEARS
300000
200000
100000
P.I. = 21.5%
EXPENSE
INCOME
DISCOUNTED CASH FLOW (TL)
10%
20%
30%
40%
DISCOUNT RATE

CHAPTER IV

CONCLUSION

In the preceding chapters I tried to prepare a " Make or buy " analysis for a part named hub, which is used in the truck assembly of Otosan. This is the solution of a problem among various ones which are faced by the company management.

Make or buy decisions are often based on a company policy of specialization and the concentration of effort and skill in some one basic line rather than responding to economic pressures to move in many directions simultaneously. But the decision rules for make or buy situations used by process planners must be based on a variety of reasons and logic. Any one of the following, or combinations of several, depending on the company, its policies, and the nature of the specific item under consideration, may be the basis for these decision rules: economic advantage; quality

considerations; reliability of supply; need for alternative sources of supply; control of trade secrets; research and development facilities of a supplier; retention of good will; reciprocity; desire to specialize activities; imposed subcontracting, as with some government contracts.

I think that the best way in making make or buy decisions in Otosan company is to follow a standard procedure. This Procedure for Making Make or Buy Decision must be as follows:

I. Analysis of the present situation.
   Economic, legal and political aspects of the problem

II. Analysis of the part selected.
   A. Its specifications
   B. Machinery and equipment required
   C. Production phases

III. Company management's view.
   Company's long-range plans must be taken into consideration.

IV. Analysis of the factors affecting make or buy decision.
   A. Capacity: Analysis of the idle capacity to make the part.
   B. Quality: Comparing the quality of the parts produced in Otosan with the parts pro-

duced by domestic firms.

C. Cost and Price: Expected cost per unit vs buying price.

D. Flexibility:

E. Delivery: Analysis of the problems created by inconsistent delivery.

F. Technical know-how:

G. Government regulations and imports restrictions.

V. Economic Analysis:

A. Cost structure: Analysis of the situation in terms of the incremental costs involved. Calculation of the cost per unit.

B. Break-even analysis: Analysis of the profits as a result of volume changes or proposed courses of action.

C. Profitability Index: Predicted interest rate of return after taxes.

VI. Conclusion.

According to the analysis in the third chapter we can conclude that

1. It is impossible for Otosan to import this part because of the:

a. Government regulations and import restriction

b. Rise in the prices of imported hubs.

2. The idea of establishing a foundry to make the complete part in the factory has not been supported by the company management because of the dissimilarity of casting business to assembling.

3. Buying rough parts from a domestic firm and machining them in the plant seems a very profitable business. Because it is possible to earn about 70 000 TL a year with an 174 000 TL investment. The approximate rate of return in this project by the accounting method is 32% (1). But the company's rate of return by this method is about 20.5%.(2) Also according to the Profitability index, the predicted interest rate of return of this project is 21.5 % (after taxes). We can easily see from these figures that Strategy II is preferable. But beside all these we have to consider some other points too, in this decision; such as:

---

(1) Rate of return : $\frac{\text{Earnings - Depr.}}{\text{Investment}}$: $\frac{70390 - 13920}{174\ 000}$

(2) Figures have been obtained from company's balance sheet:
Equity : 17 millions
Profit : 3.5 millions. yr. 1965.

a. Now the future in spare part industry seems very promising in Turkey. Government regulations and import restrictions have increased the demand for some domestic parts. But I think that these high prices and increasing demand will bring many Turkish enterpreneurs into this area and a competition will begin in this branch of industry. And as a result, I hope that the prices of those parts will fall with an increase in quality.

b. In order to provide the 40% of the parts of a truck from domestic sources, Otosan must try to establish some machinery with which they will be able to produce the "body" of the trucks within the plant. For this reason installation of large pressing machinery is necessary in the plant. Since quota distribution restricts the output of the plant, producing the bodies in the factory will open the way towards the production of trucks in larger quantities. So I think that Otosan must invest rather in this area.

c. Since there is an increasing demand for some domestic parts, it will be very profitable for Koç Holding to establish a new plant producing parts for assembly factories.

I think that Government's regulation of montage industry is a very hopeful step in the development of Turkish industry. But beside all these regulations State Planning Organization must also take some other measures to support Turkish Domestic Industry. These measures are:

1. Various types of industrial credits must be increased. In the granting of credit to industries, special considerations must be given to those which manufacture or will manufacture parts for assembly factories.

2. In order that industries which have started on the basis of assembly may pass to the process of complete manufacture, the application of the production tax must be revised and encouragement must be given to raising the percentage of domestically produced components.

3. The activities of Industrial Development Bank must be fastened.

4. The standardization and quality control of the products in this branch of industry must be carried out by government institutions.

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- Çizmecı Ltd Sti. Tünel Galata
- Elginler İnş. Ltd. Şti. Necatibey cad. İstanbul.
- Enver Soysal - Hisar Çelik, Kami.
- Haluk Akbaşoğlu - Akmetal, Fener.
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- Motor Ticaret A.Ş. Mecidiyeköy.
- Mustafa Kartkaya, Nöbethane cad. no: 125, Sirkeci.
- OTOSAN, Ankara yolu, Kadıköy.
- Türkiye Odalar Birliği, Opera yanı, Ankara.
- Özel Limited, İbrahim Özel, Demirkapı, İstanbul
- Devlet Planlama Teşkilatı, Toprak Mahsulleri Ofisi, Ankara

APPENDIX

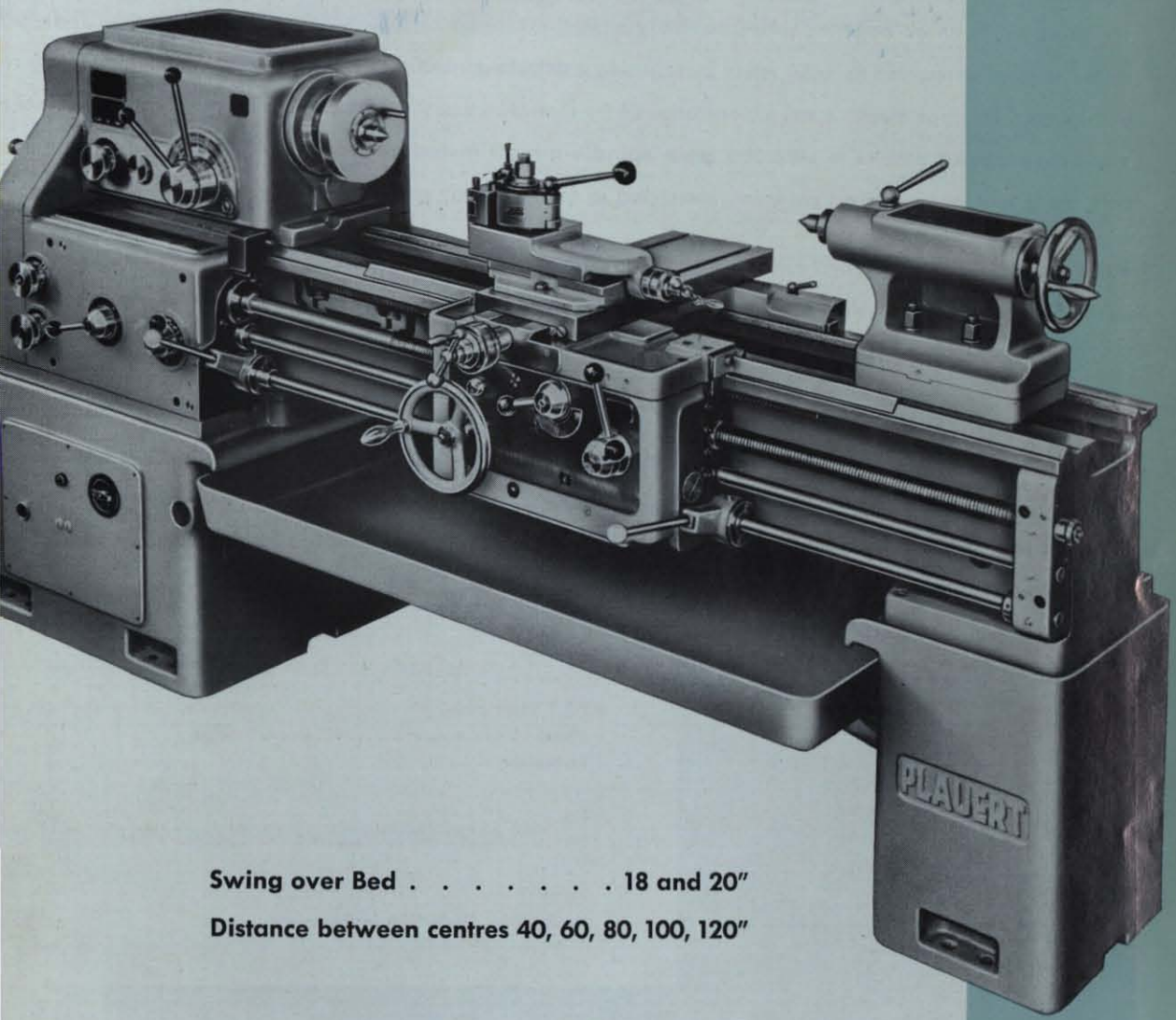
" 500 x 1000 " 16940.-
" " x 1500 " 17640.-

ex work
without footing

PLAUERT

Sliding, Surfacing and Screw-Cutting Lathes

MODELS
DL 450 AND 500



Swing over Bed . . . . . 18 and 20″

Distance between centres 40, 60, 80, 100, 120″

HAHN & KOLB · STUTTGART

BERLIN · DUSSELDORF · FRANKFORT · HAMBURG · HANOVER · MUNICH · NUREMBERG
LEIPZIG · MILAN · VIENNA · SYDNEY, MELBOURNE/Australia · SAO PAULO/Brazil

The Sliding, Surfacing and Screw-Cutting Lathes Models DL 450 and DL 500 are suitable for a wide range of applications in the production or repair shop and have won high reputation for their great efficiency and accuracy of performance. Accuracy of manufacture complying with Machine Tool Standards as per DIN 8606. Upon request increased accuracy to DIN 8605 (German Standards) can be provided against extra charge on such machines without gab in bed and up to 60" turning length.

Drive. Driving power is derived from a motor enclosed in the headstock box type leg and transmitted to the headstock pulley by means of Vee-belts. The motor is attached to the hinged rear cover of the leg and, by loosening screw and nut, it can easily be lowered for belt tensioning.

Headstock. 12 speeds in geometrical progression are obtained by shifting gears on six-spline shafts controlled by two levers only. Hardened and profile-ground sliding gears are supported on heat-treated spline shafts mounted on roller bearings.

The gears run in an oil bath, the splash thereby produced serving at the same time to lubricate bearings. The machine is started, stopped or reserved for quick return by engaging a **double-ended multi-disc clutch,** without interrupting rotation of the motor. This type ensures a smooth operation of the controls, especially at thread-cutting work. **Incorporated multi-disc brake device** enables to **stop the main spindle almost instantaneously.** The clutch can be controlled from both, apron or gear box; levers are safely interlocked so as to positively prevent unintentional releases of controls.

Main spindle - front an rear - runs on anti-friction bearings. With spindle speed range 22-1000 r. p. m. friction bearings can also be provided for the main spindle against extra charge. The bearing surfaces are then hardened and polished. The axial thrust is taken by a thrust ball bearing.

Totally enclosed feed and **screw-cutting gear box** has no Norton swing. 28 ea. length and cross feeds, as well as 19 metric, 28 inch and 13 module threads can be obtained with the aid of sliding gears, without changing gears. Module or diametral pitch threads are cut by replacing two pick-off gears. Shafts and gears are of heat-treated steel; where necessary, the shafts are designed as six-spline shafts mounted in ball bearings. Provision is made for a dependably operating drop-feet lubrication of gears and bearings.

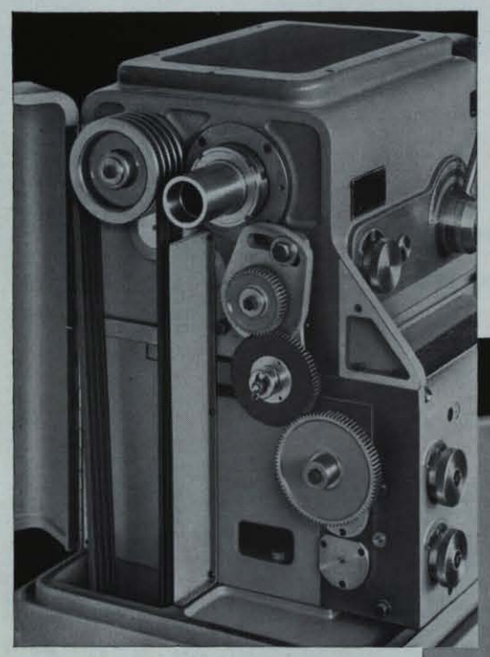


Fig. 1 (Front page)
Model DL 450 with MULTIFIX Quick-Change Toolholder

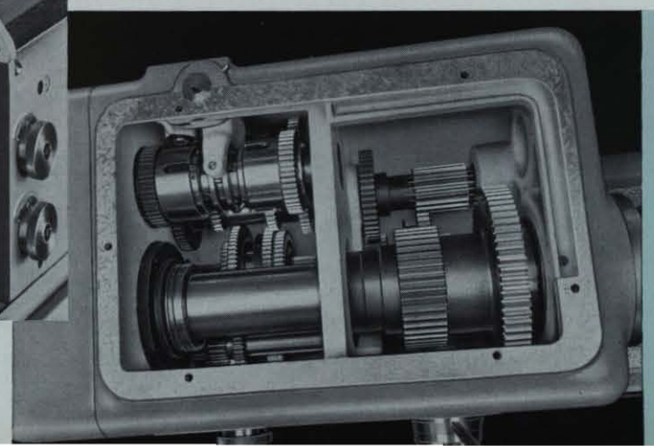


Fig. 2
Transmission of Drive to Headstock and Feed Gear Box

Fig. 3
Sliding Gear Mechanism in Headstock

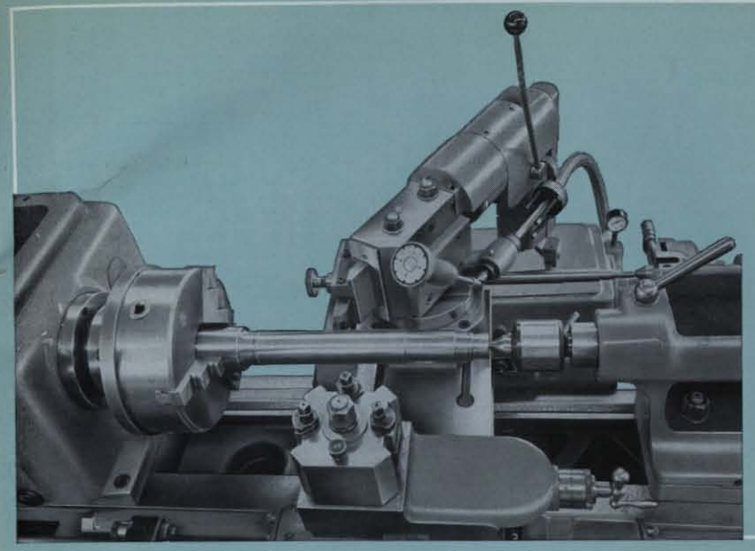


Fig. 4
Hydraulic Copy-Turning Attachment

Apron. Sliding and surfacing feeds are engaged by a trip worm serving as a safety clutch which permits also operations by the stop turning method to be carried out in either direction. Feed rod and lead screw as well as length and cross traverses are safely interlocked and can noly be engaged independently. All Shafts are mounted on two bearings. An oil pump provides **forced feed lubrication to gearings and bearings as well as to saddle and cross slide ways.**

Saddle. The saddle slides on long, precisely scraped inverted vee-ways. The front vee is protected from cuttings by long bed covers mounted on either end of the saddle. Locking gibs prevent saddle to be lifted from the bed. During facing operations the saddle is securely clamped in position by a lever. The very liberally dimensioned cross slide and the compound rest are likewise guided by long scraped ways, and fitted with readjustable taper gibs. The top slide can be swivelled to scale for taper turning or similar operations. Large micrometer dials for cross slide and compound rest screw permit easy and accurate setting and reading. T-slots at rear of cross slide serve for mounting additional tool carriers (available as extras). Standard tool post to compound rest may, against supplementary charge, be replaced by either square turret or **MULTIFIX** tool holders. The lathe can further be equipped with an hydraulically operated **Copy Turning Attachment** for dealing with profiled work, shouldered shafts, etc.; longitudinal copy-turning to master shaft or template: setting at 60° or 90° off centre of rotation, copying length 40" or 60".

Tailstock. The tailstock slides on separate prismatic guideways and may be laterally shifted on its base for turning slender tapers. The tailstock sleeve can be centrically locked by means of a handle.

Bed and box type legs. Toll diagonally ribbed lateral sections lend utmost rigidity to the broad bed. Both the vee-ways for saddle and tailstock are closely scraped. In addition to the motor, also the switch gears is housed in L. H. leg. R. H. leg accommodates coolant tank to which, - provided the equipment includes a coolant supply attachment, - a motorised pump is flanged. Both legs have discharge channels for the coolant. Upon request, the bed can be fitted with gap and gap piece.

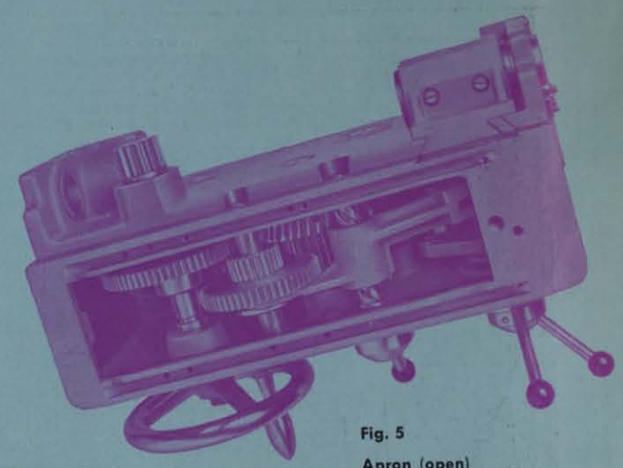


Fig. 5
Apron (open)

Technical Data:

PLAUERT Sliding, Surfacing and Screw-Cutting Lathes		DL 450	DL 500
Height of centre	mm (in.)	225 (9")	250 (10")
Swing over bed	mm (in.)	450 (18")	500 (20")
Swing over standard cross slide	mm (in.)	275 (11")	325 (13")
Swing in gap	mm (in.)	650 (26")	700 (28")
Length of gap up to face plate	mm (in.)	210 (8 1/4")	210 (8 1/4")
Dia. of face plate	mm (in.)	425 (17")	450 (18")
Distance between centres	mm	1000 - 1500 - 2000 - 2500 - 3000	
	(in.)	(40 - 60 - 80 - 100 - 120")	
Length of bed	mm	2250 - 2750 - 3250 - 3750 - 4250	
	(in.)	(90 - 110 - 130 - 150 - 170")	
Width of bed	mm (in.)	330 (13")	
Hole through spindle	mm (in.)	52 (2")	
dia. at front bearing	mm (in.)	85 (3 3/8")	
Taper of headstock centre	M.T.No.	4	
Face plate with bajonet joint, acc. to DIN 55022, size 6, flange dia.	mm (in.)	170 (6 11/16")	
12 spindle speeds, progressive ratio		1,4	
Range I of face plate speeds, roller bearings or plain (as an extra)	r. p. m.	22 – 1000	
Range II of face plate speeds, roller bearings only	r. p. m.	31 – 1400	
Driving power, standard	KW/H.P.	4/5,5	
Driving power, at face plate speeds from 31 – 1400 r. p. m. only	KW/H.P.	5,5/7,5	
Dia. of tailstock sleeve	mm (in.)	60 (2 3/8")	
Taper of tailstock centre	M.T.No.	4	
Admissible height of tools	mm (in.)	25 (1")	
Width of Cross Slide	mm (in.)	220 (8 3/4")	
Lead Screw diameter/pitch	mm (in.)	36 (1 7/16") / 15/64"	
Feeds 28 sliding feeds	mm/r	.07 – 1	
28 surfacing feeds	mm/r	.022 – .315	
Threads 19 metric pitches } Standard values	pitch/mm	.5 – 7	
28 Withw. pitches } Standard values	t. p. i.	4 – 56	
13 Module pitches } Standard values	module	0,25 – 3,5	
Coarse Thread Cutting Equipment (extra)		4:1 and 16:1	
By using this equipment, the values for feeds and pitches are multiplied by 4 and 16 respectively			
No. of legs at 1000 mm (40") to 1500 mm (60") between centres		2	
No. of legs at 2000 mm (80") to 2500 mm (100") between centres		3	
No. of legs at 3000 mm (120") between centres		4	

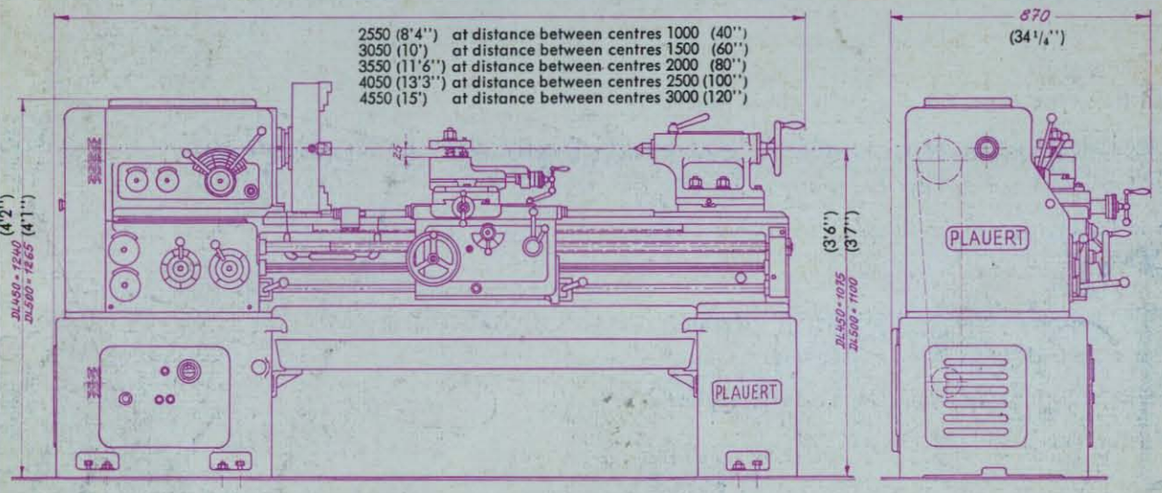
Standard Equipment: 1 catch plate, 2 centres M. T. No. 4, 1 centre sleeve in headstock, 6 change gears, 1 chip tray, 1 standard tool holder, 1 longitudinal stop with micrometer screw, 1 set of wrenches, 1 oil gun, 1 set of vee-belts, Screw Tread and Feed Charts, Operating Instructions.

Extra Equipment and Attachments:

Electrical Equipment complete with motor to suit 3-phase A. C. 220/380 or 500 Volts, 50 cs.
Stationary Stay, cap. 10-140 mm (.394"-5 1/2") ∅
Travelling Stay, cap. 10-125 mm (.394"-5") ∅
Stationary Stay with roller jaws, cap. 10-100 mm (.394"-4") ∅
Travelling Stay with roller jaws, cap. 10-100 mm (.394"-4") ∅
Stays taking non-standard diameters
Coolant Supply Attachment with motorized pump
Taper Turning Attachment, max. length to be turned 400 mm (16") angle adjustment ± 10°
Live Centre for tailstock, M. T. No. 4, 60°
1 Set of Pick-off Gears providing fine feeds from 0.035 to 0,5 mm p. rev.
Pick-off Gears for diametral pitch threads
1 Set of Pick-off Gears providing English pitch threads 11,5-13-13,5-23 and 27 t. p. i.
Kienzle Speed and Feed Selector
Thread-cutting Indicator for metric or inch leadscrew
Cross Stop Setting Device, single
Four-Way Drum Type Length Stop
Four-Way Drum Type Cross Stop
Turret Head Unit taking 6 tools, driven by hand or with mechanical drive
Universal-Rest for milling operations
a) with horizontal work table 135 x 270 mm (5 5/16 x 10 5/8")
b) with vertical work table 175 x 350 mm (7 x 14")
c) with interchangeable vertical and horizontal work tables
Tool-Post Grinder
Work Lamp
Hydraulic Copy-Turning Attachment from master shaft or template, mounted in the rear, with adjustable setting angle, copying length 1000 and 1500 mm (40" and 60")
Square Turret (to replace standard tool post)
American Type Tool Carrier (to replace standard tool post)
Multifix Quick-Change Tool Holder Type B as per separate leaflet
Tool Post Base, rear
Cut-off Toolholder, ordinary
Cut-off Toolholder, duplex
Clamping Devices (Faces Plates, Three-Jaw Chucks, Four-Jaw Chucks, Chuck Flanges, Collet Chucking Attachment)

Weights:

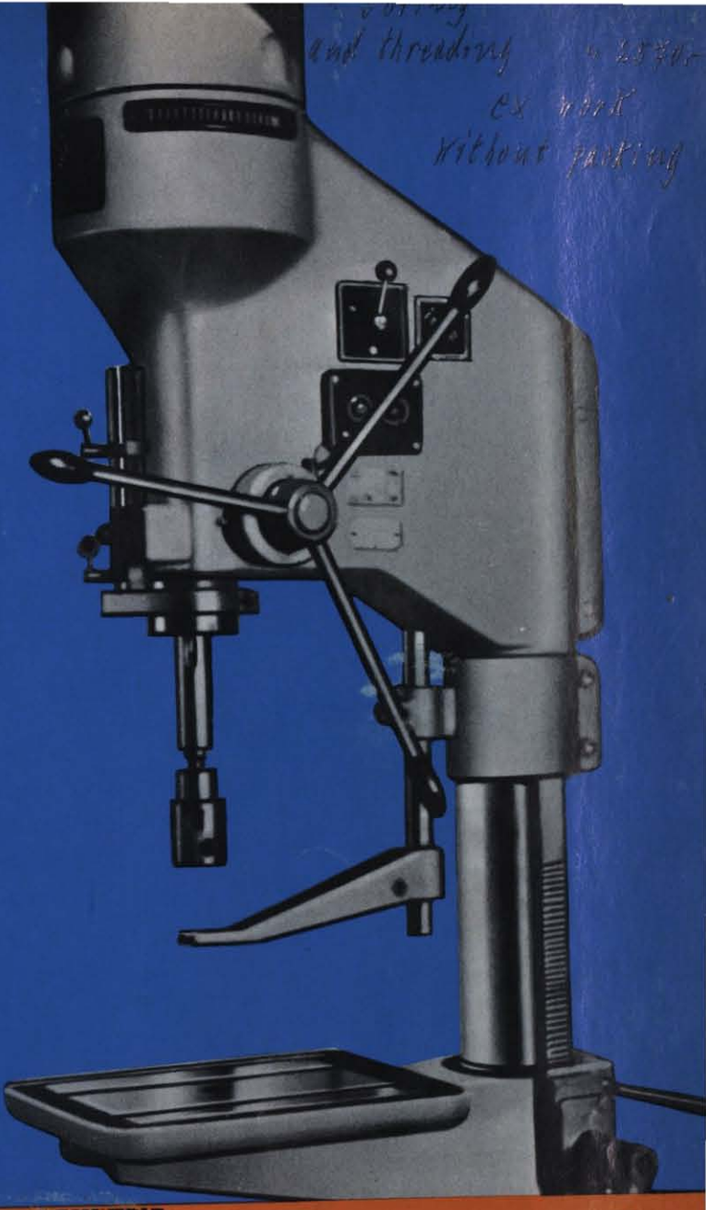
Distance between centres mm (in.)	Netweight approx. kos (lbs.) Height of centres 225 mm (9")	250 mm (10")	Grossweight incl. seapacking kos (lbs.) Height of centres 225 mm (9")	250 mm (10")	Shipping space m³ (cu. ft.)
1000 (40")	1400 (3080)	1500 (3300)	1820 (4010)	1920 (4230)	4.25 (150)
1500 (60")	1575 (3470)	1675 (3690)	2055 (4530)	2155 (4750)	5.09 (180)
2000 (80")	1840 (4060)	1940 (4280)	2390 (5270)	2490 (5490)	5.84 (205)
2500 (100")	2015 (4440)	2115 (4660)	2635 (5810)	2730 (6020)	6.51 (230)
3000 (120")	2190 (4830)	2290 (5050)	2880 (6350)	2980 (6570)	7.36 (260)



Design and specifications subject to alteration

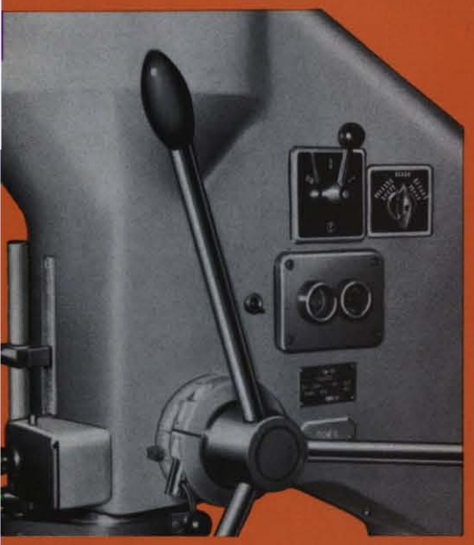
Printed in Germany

CORDIA

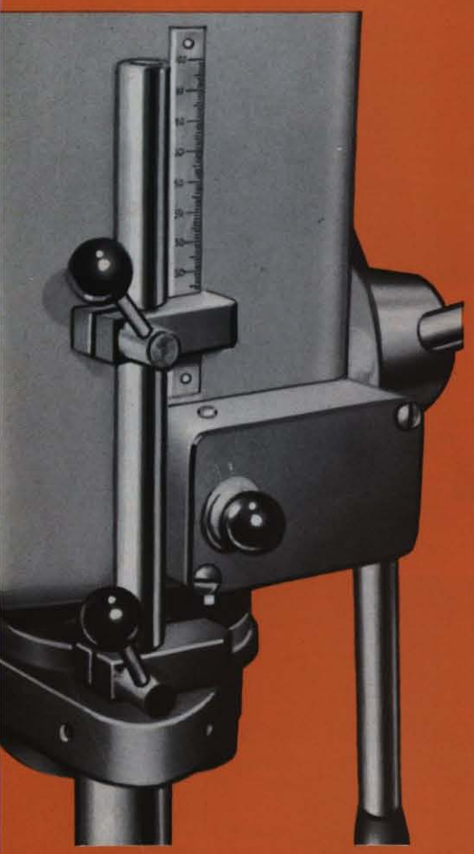


GW-30

Tapping and Drilling Machine



Switchgear



Micro-switch and
adjustable depth stops

Tapping and Drilling =

With one Machine only

GW-30

the special machine for cutting inside threads in metal of M 4 - M 20. Semi-automatically operating. Precision built throughout. This machine realizes highest demands.

GW-30

This machine works economically: If there are no threads to be cut, drilling work is to be done at every time. It is very easy to change quickly from Tapping to Drilling. Drilling capacity in steel: 1.1/8" - 1.3/16" (28/30 mm).

GW-30

offers the advantages of the CORDIA direct drive. Full utilization of the output, high overload capacity. Simple and time-saving maintenance.

GW-30

is of modern and advanced design and finish. The operating levers are conveniently and clearly arranged. Even untrained workmen will become well acquainted with the machine in a short time.

GW-30

will help you to reduce production time. Core hole drilling and tapping with the same machine - a convincing advantage.

CORDIA GW-30

CONSTRUCTIONAL FEATURES

Motor:

Direct drive by sliding gears and a triple pole-changing amply dimensioned three-phase A. C. motor.

Switchgear:

All controls are arranged oil- and dust-tight within the machine head. Protective motor switch with thermal overload relay for ON - OFF. Selecting switch with the following positions: Tapping left-hand action - Drilling - Tapping right-hand action. Micro-switch combined with adjustable depth stops for the automatic reversal of the direction of rotation to the return movement being accelerated. Trigger switch for inside machine lamp. If ordered with Coolant Pump: additional trigger switch for the Coolant Pump is provided.

Speeds and Gear:

9 conveniently stepped-off spindle speeds which are obtainable in 3 series at full speed of the machine. Lubrication by circulation of the oil. All gear wheels passed a nitriding process (TENIFER). All spindles mounted on ball or pin bearings.

Electro-Magnetic Multi-Disc Clutches:

(Manufacture Ortlinghaus) effect the reversal of the direction of rotation by reversing gear. The main advantage of this method of reversal: The stress on the motor is reduced by its non- reversing.

Tapping:

Semi-automatic operation. The electro-magnetic multi-disc clutch is controlled by a micro-switch and adjustable depth stops. The reversal accuracy is .001 inch (0,03 mm) and gives max. precision when tapping blind holes. The tap is set up on the drilled workpiece until it holds. Then it gripes of its own accord until the pre-set depth of thread has been reached and returns to the initial position at accelerated speed. After this the spindle automatically receives the direction of the working rotation again. The thread cutting process is thus automatic. The accomodation of the pull-back force, being effective from the spindle to the material, is given by an adjustable pull-back spring. Manual operation of the micro-switch for reversal of rotation is also possible.

Drilling:

For drilling work the selecting switch is to be set on "Drilling". Then the machine can be used for drilling holes in steel of 1.1/8" - 1.3/16" (28/30 mm).

Construction and Equipment:

Substantial pedestal machined from high quality casting, column ground. Worktable can be swung 360° around the column. The distance between spindle and working surface of base is 47.1/4" (1200 mm), thus permitting that even bulky and awkward pieces can be machined. A separate round turntable can be supplied for setting-up on the right-angled worktable. The worktable arm is provided with a fitting area in a right-angled position to the table. A carrier arm can be attached to the fitting area, taking an insertion vice. Inside lamp and a holding down appliance belong to the standard equipment of the machine.

Accuracy:

The accuracy of the machine complies with the requirements for the inspection and acceptance of Machine Tools/Upright Drill Presses according to DIN Standards 8626.

You will save time with

Lever for gear reversal,
Control knob for pull
back spring, oil sight glass

Round turntable and
holding down appliance

CORDIA GW-30

CORDIA GW-30

Tapping and Drilling Machine

TECHNICAL DATA

Tapping capacity in steel	M 4 - M 2
Drilling capacity in steel	inch. 1.1/8 - 1. mm 28/30
Spindle speeds	rpm. 90/120/ 270/350 720/950
Motor output	kW 1,2
Max. spindle travel for tapping	inch. 4.3/4 mm 120
for drilling	inch. 4.3/4 mm 120
Spindle has Morse Taper Hole	MT-3
Max. distance from spindle to base	inch. 47.1/4 mm 1200
Working surface of table	inch. 15.3/4 x mm 400 x 35
of base	inch. 17 x 15 mm 430 x 38
Working radius	inch. 11.13/16 mm 300
Diameter of column	inch. 4.3/4 mm 120
Overall height	inch. 89.11/16 mm 2278
Weight	lbs. 639 kg 290

PRICES

CORDIA GW-30 suited for operation onThree-phase A. C. mains with holding down appliance and inside lamp	DM
as Bench model (suited for Multi-Unit Drilling Machines)	DM
Increase for special voltage	DM

Extra Equipment

Coolant Pump with fittings	DM
Vice 4.5/16" (110 mm)	DM
Insertion vice 3.15/16" (100 mm)	DM
Carrier arm for insertion vice	DM
Separate turntable 19.5/16" (490 mm) ⌀	DM
Taper arbor MT-3 for drill chuck with cone B-18	DM
Comb. two-jaw drill chuck with movable driving jaws for twist drills 5/8" and machine taper-tap (DIN 376 M 4 - M 20)	DM

Change in prices and construction reserved. Prices apply to voltage 220 or 3
50 cycles.

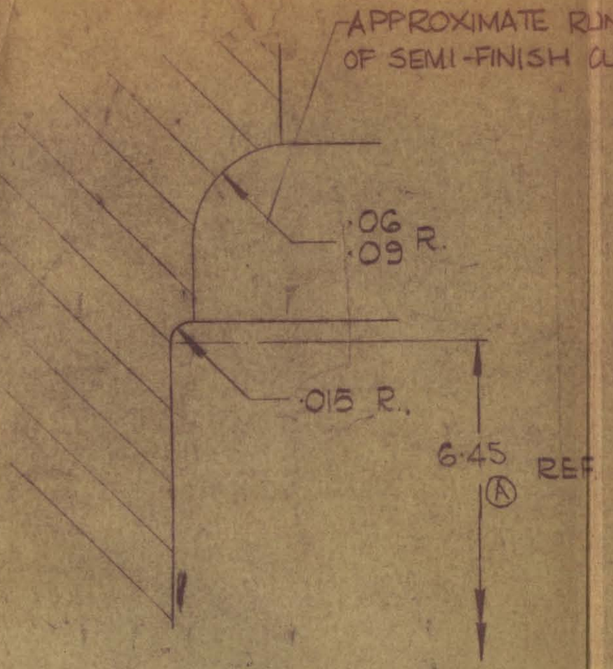
Printed in Germany

Imprimé en Alle

Hahn & Kolb-Stuttgart

DECISION MATRIX

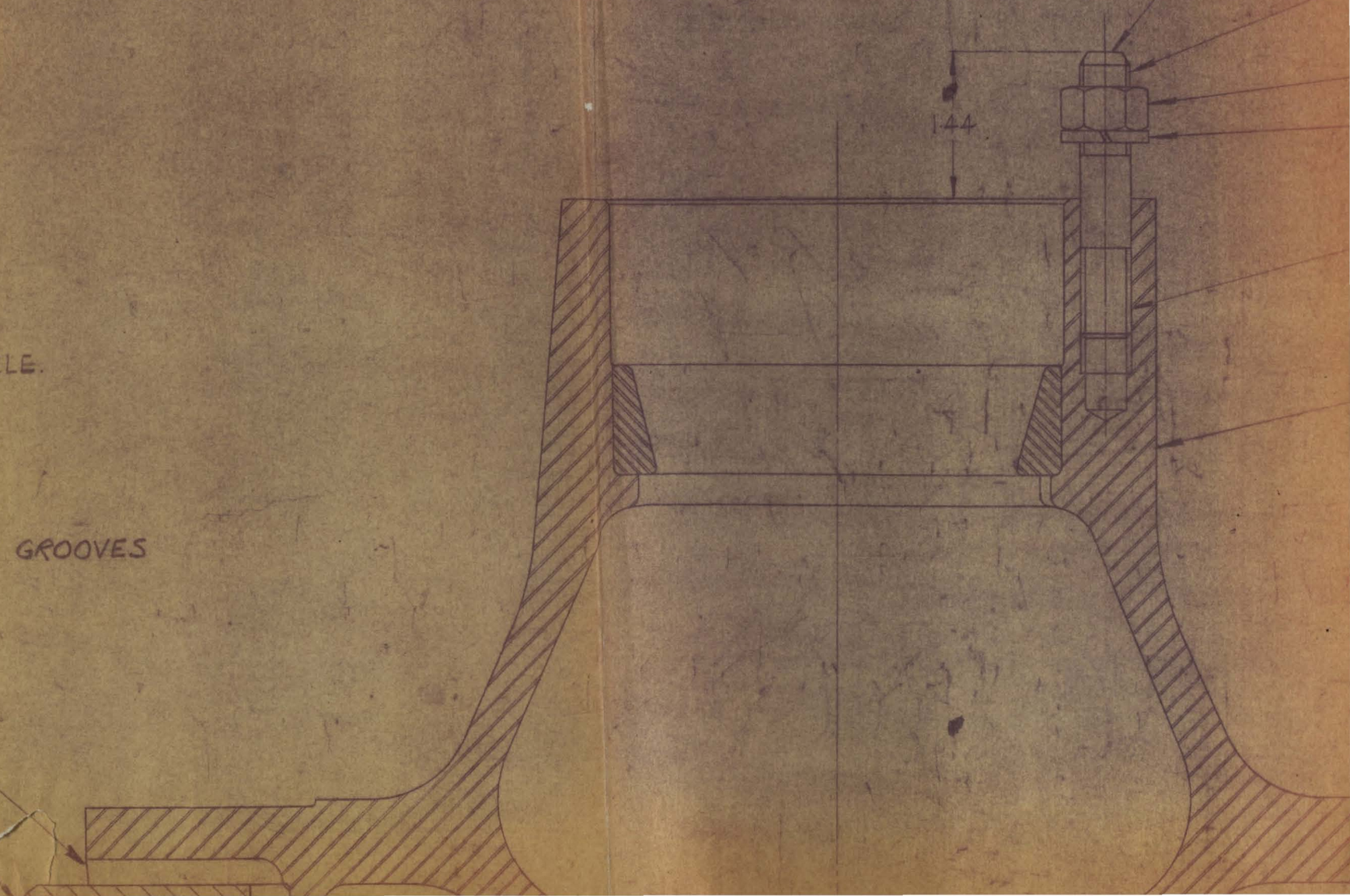
	STRATEGY I Buy it from domestic industry	STRATEGY II Buy it rough and machine it	STRATEGY III Import	STRATEGY IV Otosan Production
PLANT SPACE	No change	50 m² is required (this area can be found in the plant)	No change	200 m² is required Foundry can't be established
MACHINERY	No change	2 Lathes 2 drilling machines 2 drill jigs	No change	Mold boxes Annealing furnace Lathes Drilling machines + Jigs
LABOR	No change	2 workers for lathes 2 " . drilling m. 1 " . general purp.	No change	1 worker for modelling 2 workers . casting 1 worker . annealing 2 " . lathe 2 " . drilling
ADMIN.	No change	No change	No change	1 metallurgical engineer 1 Prod. Control foreman 1 clerk
CAPITAL	No change	174 000 TL is required	No change	240 000 TL. is required
QUALITY	Low Quality	Better quality in machining	Best quality	Better than domestic industry
PRICE	Front hub: 175-TL Rear hub: 200-TL.	Costs: Front hub 170.46 TL Rear hub 195.45 TL.	Front hub: 351.31 TL Rear hub: 421.20 TL	Costs are lower than those in domestic ind.
KNOW-HOW	Lack of technical know-how	Better know-how	No trouble	Better know-how
DELIVERY	Inconsistent	Delivery of the rough parts is inconsistent	No trouble	No trouble
FLEXIBILITY	Very flexible situation	Flexibility is not disturbed	Very flexible situation	Flexibility is disturbed
GOV. REG.	No problem	No problem	Hub was raised from the Quota list in 1965	No problem



SCRAP SECTION SHOWING AREA IN CIRCLE.
SCALE - TEN TIMES SIZE.

CUT-OUTS IN DRUM TO COINCIDE WITH GROOVES IN HUB AS SHOWN.

2000E-112G-R DRUM Ø



DATE	LET.	REVISIONS	REL. NO.	DR	CR
[illegible]		RELEASED	ET 7400	[illegible]	
	(D)	6-45 Dim WAS 6-47 / 6-45			

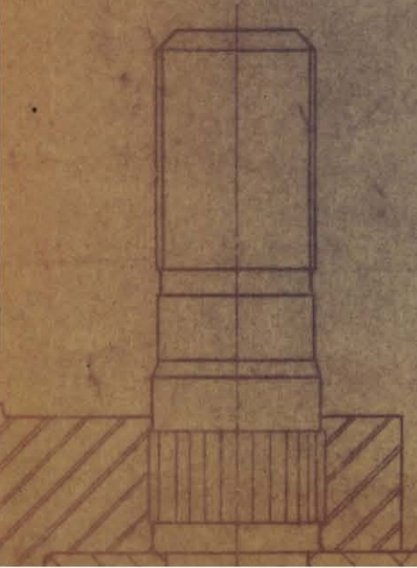
USE SLEEVES FOR PROTECTION DURING SHIPPING ONLY.

13791-ES - STUD 12 REQ'D.

33846-S2 - NUT 12 REQ'D.
34809-S2 - WASHER-LOCK 12 REQ'D.
} NOT SUPPLIED WITH ASSY. AS PURCHASED.

USE SEALANT EM4G-52 AS SPECIFIED.

2000E-1K000-S - HUB, STUD & BEARING CUP ASSY. - REAR - RH ——— FOR 2000E-1113-AB
2000E-1K001-G. HUB, STUD & BEARING CUP ASSY. - REAR LH ——— FOR 2000E-1114-Y



113461-ES2 - WASHER 10 REQ'D.

USE SEALANT EM4G-47 AS SPECIFIED BETWEEN DRUM & GREASE BAFFLE

PLACE TRADEMARK OF COMPANY MACHINING ASSY. HERE

6·45 Ⓐ

8·14

2000E-2240-P GREASE BAFFL

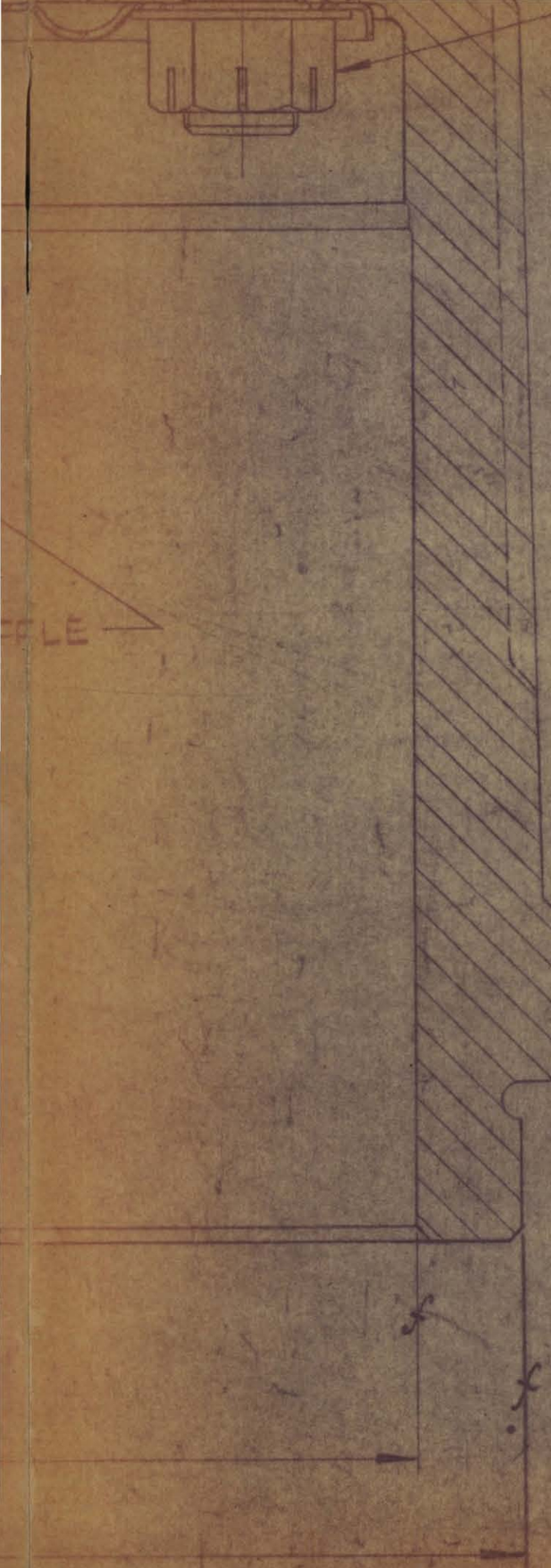
60
100

FACE 'X'

15·500 DIA. 'B'
15·505

16·81 DIA.

2000E-1114-Y	L.H.
2000E-1113-AB	R.H.



34380-S2-NUT 10 REQ'D.
FOR TIGHTENING TORQUE
SEE ECH-69-508E.

SURFACE FINISH SHOWN THUS ✓
IS AN ARITHMETICAL AVERAGE.

WHEN ROTATED ON BEARING CUPS.
DIA. B TO BE CONCENTRIC WITHIN
.005 T.I.R MEASURED .75 - 1.00
FROM FACE X.

MACHINED SURFACES TO BE SUITABLY
PROTECTED AGAINST CORROSION
DURING SHIPPING & STOWAGE.

PARTS MARKED THUS Ø ARE
TRADEMARKED.

FINISH :- SEE DETAILS.

No. 2000E-1113-AB

19 Subat 1965

DATE ISSUED :-

3RD. ANGLE PROJECTION
ALL DIMENSIONS IN INCHES

REFERENCE	18,500, 19,500 lb. AXLE SMMT & STD.			
DRAWN BY	COMPLETED	CHECKED	APPROVED	SCALE
J. Watkins	OCT-11-63			FULL

UNLESS OTHERWISE SPECIFIED
ALLOWABLE VARIATION ON DIMENSIONS CONTROLLING
FINISHED SURFACES IS ±.010

MATERIAL

APPROVED

DATE

SEE DETAILS.

NAME
HUB & DRUM ASSY - REAR

PART No.
2000E-1113-AB