WORK TERM-I

VENUE: EICHER TRACTORS LTD.
PARWANOO (H.P.)

DURATION: 1ST JAN TO 30TH JUNE.

REPORT PREPARED
BY
AJAY UPPAL

I, AJAY KUMAR UPPAL, student of THAPAR INSTITUTE of Engineering and Technology, Patiala, have completed my WORK TERM-I with EICHER TRACTORS LIMITED, PARWANOO (H.P.). My efforts, recommendations, performance and attitude towards work can be felt by going through this report. I will be solely responsible for mistakes of any kind. Any suggestions or questions regarding this will be entertained.

Thanks to readers for sparing their precious time.

Report preparation Scrap Analysis :-

Report prepared by

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Motion Study :-
Time "
Scrap :-

Motion
Time Study

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I sincerely thank Mr. SHASHI BHUSHAN, Deputy Manager, Mr. M.T.Pathak, Assistant Manager and Mr.HEMANT SHARMA for their guidance and inspiration. I was offered interesting projects during WORK TERM-I and with their help and attention, the projects were sucessfully undertaken.

I especially thank Mr.R.C.BAHL, H.O.D.,T.I.E.T, PATIALA for his timely visits. He encouraged me and imparted guidelines which helped me in a big way. His visits certainly increased involvement of people in my work Term.

Lastly I thank all shop supervisors and others who supported me and guided me well.

AJAY KUMAR UPPAL
132/85,I.E.
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EICHER TRACTOR LIMITED

SYMBOL OF DYNAMISM IN ENGINEERING

Eicher started its career from its original name 'Eicher Good Earth' Ltd. It was first Indian tractor manufacturing company. The venture was set up in collaboration with 'Gieber Eicher' of West Germany. The venture started in 1953-54 and Mr. M.M.Lal was the Managing Director at that time. For first six years tractors were assembled from imported components. In 1960 first indigenous Indian tractor rolled out of Eicher assembling line. It was completely manfactured and assembled in India at Faridabad. In first thirty years Eicher build a very impressive track record and is placed among top growth oriented companies in the country. Eicher's contribution towards the development of Ancillary industries and research and technology have not only been recognised by National organisation but also abroad. Now it is a 100 crore company.

DIMENSION OF GROWTH

Starting with assembly of imported parts of tractors for the first six years then EICHER started manufacturing and assembling the tractors in Faridabad. Then to cope with increasing demand in the Market, Parwanoo unit was set up as a part of expansion of Eicher.

Also by studying the market and looking into the need of customer Eicher felt the need of having itw own research and development centre which is at present located at Ballabgarh. Along with improved models of tractors Eicher has also been producing other consumer products like generator sets and pumps sets. Light commercial vehicles are also being produced by Eicher in collaboration with MITSUBISHI of Japan and is marketed in name of Canter. It has emerged as leading profit grosser among the various Eicher products.

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Following projects were offered to me which I under took carefully and seriously.

i) Analyse loss of productivity in different shops due to various reasons such as N.S.T., Rejection, rework, incorrect booking study the impact due to different reaso and find out methods to minimise such losses.

ii) Identify and implement methods for work simplification in Medium Machine Shop. Areas to be covered are

a) Material Movement

b) Components loading & unloading.

c) Clamping & Unclamping.

d) Sequence of elements.

e) Inspection methods and delays.

iii) Identify and implement methods for work simplification in Light Machine Shop relatec to different aspects of various operations.

iv) Preparation of basis for Budget

a) Carrying out of Inventory exercise. Enlisting of dead stock, excess stock and dead stock value.

b) Segregation of the tools being used with respect to the item being produced by them.

c) Determination of direct tooling cost per item.

d) Preparation of data regarding budget.

v) Collection of data regarding pre-machining/pre-broach and blank turning with a view to improve the entire process economically.

WORK TERM -I

Sr.No. 1	Objective 2	Analysis done 3	Observations 4	Conclusion/Recommendations. 5
1.	Analyse loss of Productivity.	Following causes indentified and analysed. i) N.S.T(those operations whose time Stds are not established)	Overall loss due to N.S.T.= 6%	Steps should be taken to ensure faster setting up of time stds. Possibility of setting up interim standards to be examined. Present time stds. should be reviewed
		ii) Rework	Overall loss due to rework = 8%	i) Efforts should be made to improve process capability of M/cs or installation of new M/cs with better process capabilities.
		iii) Rejection; entire plant's rejection summary studied.	Overall loss due to rejection is about 10%	ii) Frequent inspections to be introduced at stages/operations with high rework or rejection. iii) Operator to be trained to use M/cs and tooling efficiently. iv) Design of jigs and fixtures should be reviewed for operations with high rework or rejection.
		iv) Incorrect booking exercise carried in M.M.S and gear shop	This was observed to be in-significant.	Filling of Daily production reports appears to be okay based on sample studies done.
2.	Material Handling system in medium machine shop (Production shop producing transmission Housing weighing 35 to 45 kg per pc.)	There are 21 helpers per day involved in material handling. Total no. of pcs. made in single day is 100. Movements per pc.=40 Total movements=4000	If a conveyor is introduced the problem of material handling will be solved. Nos. of helpers required will reduced to 3/4.	i Conveyor system should be introduced. Recommended speed of conveyor should be five metre per minutes. ii) Gravity chutes should be encouraged. These have been implemented. iii) No. of hoists should be increased so that each milling operation is supported by one hoist. This will facilitiate loading and unloading and movement from one place to another.

1	2	3	4	5
2	Material Handling	The present system is partly mechanised and partly manual. Electric hoists are being used along with products trolleys.		
3.	Work simplification	Lot of time is consumed during loading, clamping, unclamping & unloading. Moreover the jigs and fixture s ask for operators efforts.	Unproductive time can be saved by using more appropriate jigs and fixtures, so that efferts on part of operator is decreased.	In case of parting off, Con Rod 115, two jobs can be held simultaneously to ensure higher productivity. Fixture has been designed and is under implementation. ii) Alternatively cutting wheel can be used for parting off operation.
		During clamping and unclamping om M/c F N 3H operator has to put lot of energy and effort.	Job is held by 4-clamps i.e. more time is consumed.	Fixture with two clamps should be manufactured so as to safe clamping time and effort.
			On machine FN3H D1/D2 side milling, 3 clamps are being used. Thus man time is large.	To reduce man time, fixture with two clamps has been proposed and accepted.
			Drilling jig for G1 top side should be modified.	C-washer can be used for clamping purpose instead of present 4 clamps.
		Operation like drilling, taping and reaming observed and studied carefully.	It is observed that lot of time and effort is consumed in drilling, taping and reaming as tools have to be changed now and then. Collets and chucks are not proper.	Quick change tapping tool holders introduced. These will ensure multi spindle drilling and tapping operations for faster rate of production. Tool changing can be carried with spindle stationery or running.

1	2	3	4	5
4.	Analysis of tooling	i) Codification of items in the company (850 Nos. and 40 categories) based on specifications of different items.		This system has been implemented.
		(ii) INVENTORY Available stock was identified and dead stock along with excess stock was found.	a) Tools worth 14 lacs are lying in the dompany. b) Value of tools in use is about 7 lacs. c) Dead stock ~~xx~~ value is 5.25 lacs. d) Excess stock value is 70,000.	In order to prevent creation of dead stock, following steps should be taken: a) Whenever a new tooling is introduced, action on outgoing tooling should be taken immediately by cancelling all orders and disposal of earlier stock. b) The tooling likely to get altered by future design changes, process changes should be closely monitored and have minimum stock.
		iii) Working out of tooling cost.	Component wise tool consumption analysis was carried out and cost of each component is worked out.	Standard tool consumption data was made for all compoents. The tooling cost was compareable with the budget of last year. Variation was due to price hike. This data was useful for preparation of tooling budget.

PROJECT NO. 1

ANALYSIS OF LOSS OF PRODUCTIVITY DUE TO

N.S.T., REWORK, REJECTION & INCORRECT BOOKING

PROJECT NO. I

Productivity is defined as a balance between all factors of production that will give the greatest output for the smallest effort. Dynamic and purposeful utilization of the resources in order to get maximum out of the existing resources is known as productivity.

Productivity can be made higher through any of the following step.

i) Maintaining the input & increasing the output.

ii) Maintaining the output & decreasing the input.

iii) Increasing small amount of input to get larger output.

Factors which effect productivity in Eicher Tractors Limited are following:

i) N.S.T

ii) Rejection

iii) Rework

iv) Incorrect booking

ANALYSIS OF N.S.T IN EICHER TRACTORS LIMITED & METHODS TO IMPROVE IT

I started with non std. time that is N.S.T.

It was observed that machines which do not have Std. times are used in efficiently and in-uneffective manner.

Workers know that even if they produce 10 pcs, 20 pcs, 30 pcs or 50 pcs., they will be getting a same output hours; equivalent to input hours i.e their PI will be 100 therefore production on such machines is low and hence productivity is low.

My job was to standardise timings and I did the same for different operations after studying the nature of the operation. For standardising and operation I observed it about 6 - 10 times, depending upon its nature I carried production study. After giving relexation allowances and other allowances I calculated the required No. of pcs. which should be produced at 100 PI and compared this No. with the actual production.

N.S.T. PART IN LIGHT MACHINE SHOP

In L.M.S following four components are manufactured/processed.

I) Connecting Rod 298

2) Cam Shaft 298

3) Connecting Rod 115

4) Cam Shaft 115

In all there were 10 N.S.T. operations in Dec'87. I carried out production study for the operations & got the results. Most of them have been implemented with few modifications.

<u>N.S.T. OPERATION IN L.M. SHOP</u>

1. Con rod = 298 Honing

Observed time = 8.0 minutes

Allowance on machine time = 10%

Machine time 1.10 (8.0) = 8.80 m

Main time inclusive of allwances = 1.15 (2.00)
= 2.30 minutes

Total time per job = 8.80 + 2.30
= 11.10 m

Standard time = 11.10 minutes

Effective minutes in a shift of 8 hrs. = 480

Therefore no. of pcs per shift $= \frac{480}{11.10}$
= 44

Actually produced = 30

Loss $\frac{44(-) 30}{44} = \frac{14}{44}$ = 32%

2. Bush Boring Con Rod 298

O.T. = 8.25 minutes Allowance = 20%
S.T. at 100 P.I = 8.25(1.2) = 10.3 m
No. of pcs per shift of 8 hrs $= \frac{4.80}{10.3}$ = 46

Pcs actually bored = 17

Reqd no. of pcs 450 minutes = 42

Loss 42(-) 17 $= \frac{25}{42}$ = 59%

3. Step milling Con Rod 298

O.T. = 5.0 minutes

Machining time = (1.10) (5.0)= 5.50 minutes

Man time inclusive of 15% allowance $= \{15/100 (1.5) + 1.5\}$ = 1.73 m

Total time per job = 5.50 + 1.73
= 7.23 minutes.

Setting time per shift	= 30 minutes
Effective minutes in a shift of 8 hrs.	= 480 (-) 30 = 450
S.T.	= 7.23 minutes.
No. of pcs per shift of 8 hrs.	$= \frac{450}{7.23} = 62$
Actual produced	= 45
% Loss $\frac{62(-)45}{62} = \frac{17}{62}$	= 28%

4) Oilhole drilling Con Rod 298

O.T. = 3 m S.T. = 3.6 m

Allowance = 20%

No. of pcs. that can be produced in 8 hrs. $= \frac{480}{3.6} = 133$

Actually produced = 60

$$\text{Loss} = \frac{133 - 60}{133} \times 100 = 55\%$$

5) Cam Shaft 298 Grinding of all cams.

O.Times = 26 m Allowance = 20%

S.T. = 31.2. minutes

No. of pieces that can be produced in 8 hours = 15

$$\text{Loss} = 15-7= \frac{8}{15} \times 1000 = 53.33\ \%$$

6) Cam Shaft 298 Taper dia Grinding

O.T. = 4.25 m inclusive of inspection,

Allowance = 20% S.T. = 4.25 x 1.2 = 5.1 m

$$\text{Piece per shift} = \frac{480}{5.1} = 94$$

Actually produced = 55

$$\text{Loss} = \frac{94-55}{94} = \frac{39}{94} \times 100 = 41.48\%$$

7) Cam Shaft 115

Centering & facing

O.T. = 2.5 minutes allowance = 20%

$$\text{Pieces/ shift of 8 hrs.} = \frac{480}{3} = 160$$

Actually produced = 100

$$\text{Loss} = \frac{160-100}{160} \times 100 = 37.5\%$$

8) **Grooving 6.5mm Cam shaft 115**

O.T = 2.5 minutes Standard time = 3.0

No. of pieces to be grooved = 160

Setting time = 15 minutes

Effective minutes = 465 m.

No.of pieces that can be grooved $= \frac{465}{3} = 155$

Actually Grooved = 70

Loss = 155 - 70 = 85

Loss $= \frac{85}{155} \times 100 = 54.84\%$

9) Grooving 3.5mm Cam shaft 115

O.T. = 2.5m Standard Time = 2.5 × 1.2 = 3.0

Setting time = 15 minutes

Effective minutes = 465 minutes

No. of pieces that can be grooved. $= \frac{465}{3} = 155$

Actually grooved = 80

Loss $= \frac{155 - 80}{155} \times 100 = \frac{75}{155} \times 100 = 48\%$

10) Taper Grinding Cam shaft 115

Observed time = 2.5 minutes - Allowance = 20%

Standard time at 100 P.I = 2.5 (1.29 = 3.00m.)

No. of pieces that can be produced $= \frac{480}{3}$

Actually produced = 85

Loss $= \frac{160 - 85}{160} \times 100 = 47\%$

=-=-=-=-=-

T.I-E.T.

~~ACTUAL PRODUCTION~~

	COMPONENT OPERATION	STANDARD TIME	ACTUAL PRODUCTION	SETTINGG TIME	EFFECTIVE TIME in a shift of 8 hrs.	USEFUL TIME Output hrs	INPUT Hrs.
	1	2	3	4	5	6	7
1.	Con Rod 298 Honing	11,10m	30	-	480m	5.40 hrs.	8.00
2.	Con Rod 298 Bush boring	10.3 m	17	30 minutes	450m	3.42 hrs.	"
3.	C.R.298 Step Milling	7.23 m	45	30 minutes	450m	5.92 hrs.	"
4.	Oil hole CR 298 drilling	3.6 m	60	-	480m	3.60 hrs.	"
5.	Comshaft 298 grinding of all cams	31.2 m	7	-	480m	3.64 hrs.	"
6.	C.S.298 Taper grinding	5.1 m	55	-	480m	4.68 hrs.	"
7.	Comshaft 115 centring & facing.	3.0 m	100	7-	460m	5.00 hrs.	"
8.	Comshaft 125 grooving 6.5 mm	3.0 m	70	15 minutes	465m	3.75 hrs.	"
9.	Comshaft 115 grooving 3.5 mm	3.0 m	80	15 minutes	465m	4.25 hrs.	"
10.	Comshaft 115 taper grinding.	3.0 m	85	-	480m	4.25 hrs.	"

1 2 3 4 5 6 7

Output hours during a shift = 43.91 hrs.

Input hours = 80.00 hrs.

loss = 80.00 (-) 43.91 = 36.09 hrs

percentage loss = $\frac{36.09 \times 100}{80}$ = 45%

As per input hours corresspondinq
to N.S.T operations

Approximately 45.0 % of input time is wasted in L.M.shop on N.S.T. operations. This productivity is very low in case of N.S.T. operations.

IDLE TIME REPORT GEAR SHOP FOR THE MONTH OF JAN.'1988'

Dated: 8.2.88

S. No.	Machine Name & Item code.	1	2	3	4	5	6	7	8	9	10	11	12	Total time	Time Avl. on m/c.	%age Idle time
1.	H-400(Old)	26.45	6.50	-	-	-	-	203.25	-	-	19.50	12.75	-	268.45	540.00	49.71
2.	Cooper Ist.	42.00	6.50	-	-	-	-	56.50	-	-	-	-	-	105.00	540.00	19.44
3.	Cooper 2nd.	29.00	5.50	-	-	26.50	-	11.15	-	-	-	17.50	-	89.65	540.00	16.60
4.	Mesh-Ist.	10.50	4.75	-	-	4.00	-	56.00	2.00	-	14.00	3.00	-	94.25	384.00	24.54
5.	Mesh-2nd.	22.50	5.00	-	-	4.50	4.00	42.50	-	-	8.00	10.00	-	97.50	384.00	25.39
6.	Toss	6.50	-	-	-	-	-	217.50	-	-	7.50	-	-	231.50	384.00	60.28
7.	H-400(New)	15.00	1.00	-	1.50	-	-	145.00	-	-	28.00	12.50	-	203.00	540.00	37.59
:	TOTAL	151.95	29.25	-	1.50	35.00	4.00	731.90	2.00	-	77.00	55.75	-	1089.35	3312.00	
:	%age Idle Time	13.94	2.68	-	0.13	3.21	0.36	67.18	0.18	-	7.06	5.11	-			
:	%age of Total Idle Time Avl.	4.58	0.88	-	.04	1.05	0.12	22.09	0.06	-	2.32	1.68	-			

(13)

Total Machine Hours Avl. = 3312.00 hrs.
%age of Idle Time = 32.82

Code: 01.Setting Change, 02.Tool Change, 03.Tool or Cutter Tryout, 04.Inspection delay, 05.Machine under maint., 06.No power , 07. No Load, 08.No Tool, 09.Any other reason, 10.No operation, 11.Operator worked on other machine, 12.No Tool because of Hob Resh.machine under maint.

(K. S. THAKUR)

CC: HS, JS, BCS, BG, RKS

sr/kst.

MEDIUM MACHINE SHOP

N.S.T.Operation

Following operations were standardized after carrying production study. After observating an operation for 5 to 6 times, I got the following data:

1. D1/D2 dowelling G2 353

Loading = 40 S Unloading of jig = 20 s

Unloading of job = 20 s

Machine in time = 150

Total observed time = 150 + 40 + 20 + 20

= 230 s

O.T/one side $= \frac{230}{60}$ = 3.8 minutes

Total time for both sides = 3.8 x 2 = 7.6 m

S.T. = 7.6 x 1.2 = 9.12 m

Allowance = 20%

No. of jobs which can be completed $= \frac{480}{9.12}$ = 52

No of pieces produced = 28

loss = 52(-) 28 = 24

$= \frac{24 \times 100}{52}$ = 46%

2. G 242 25 H7 Boring

Loading = 3 minutes.

Unloading = 3 minute s.

Machining time = 7.0 minutes.

Unloading charges of tool.

Total observed time = 13 minutes

Allowance = 20%

Standard time = 13 x 1.2 = 15.6 m

No. of pieces whch can be bored $= \frac{480}{15.6} = 30$

Actual produced $= 14$

loss 30(–) 14 $= 16$

$= \frac{16 \times 100}{30} = 53.33\ \%$

N.S.T. PART IN GEAR SHOP

1. F.D.Gear 242

Operation - Hobbing

Objective - Standardization of time

Theory: 1) Hobbing length = Length to be hobbed + approach to cutter + safe distance

Where length to be hobbed = width of gear

ii) Approach to cutter = Square root [h(D-h)]

Where h = tooth deptt.

and D = Diametre of cutter

iii) Safe distance = Clearance

Cutting Parameters

R.P.M. of cutter = 13.8

Feed = 1.6 mm per revolution

Safe distance = 2 mm

Width ofgear = 38 mm

Since 2 gears are simultaneously hobbed the total width = 38 x 2

= 76 mm

Therefore length to be hobbed = 76 mm

Approach to cutter = Square root h(D-h)

= Square root 10(110-10)

= Square root 1000

= 32 mm

Hobbing length = 76 + 2 + 32 = 110 mm

Hobing time = $\dfrac{\text{Hobbing length x No. of teeth}}{\text{feed x r.p.m. of cutter}}$

$= \dfrac{110 \times 73}{1.6 \times 13.8} = 36.5$ minutes

Machine time $= \frac{10}{100}(36.5) + 36.5$ minutes

$= 36.5 + 3.65$

$= 40.15$ minutes.

Man time $= 1.15 (4.00)$ minutes

$= 4.6$ minutes

The for hob shift per loading = 2.00 minutes.

Total time for two gears $= 40.15 + 4.6 + 2.00$

$= 46.75$ minutes

No.of jobs per shift $= (480/ 46.75) \times 2$

= 8.00 hrs.

= 20

No of components actually produced = 16

Loss 20 (-) 16 = 4

Loss as per input hrs $= \frac{4 \times 46.75}{480} \times 100$

= 38 %

Mean

CT. TMT

OT Loadn

GEAR SHOP TIME STANDARDS

Following time standards were proposed in gear shop for

<u>High Point Removal</u>

1. F.D.gear 242

   observed time = 100 m

   Allowance = 20%

   Standard time per piece = 1.2 x 10.0 = 12m

   No. of pcs per shift at 100 P.I = $\frac{480}{12}$ = 40

2. F.D.Gear 352 O.T.= 11.5 m Allowance = 20%

   Standard time = 13.5 minutes.

   No of pcs/ shift at 100 P.I. = $\frac{480}{13.5}$ = 36

3. Bull gear 241

   O.T. = 8 m

   Allowance = 20%

   S.T.=9.6 m

   No. of pcs per shift = $\frac{480}{9.6}$ = 50

4. ~~Super~~ Spur pinion Ist

   O.T. = 8 minutes

   Allowance = 20%

   Standard time = 9.6 minutes

   No of pcs per shift = 50

5. Spurpinion IInd

   O.T. = 8 minutes

   Allowance = 20%

   S.T. = 9.6 minutes

   No. of pcs per shift = 50

6. Spurpirion IIIrd

O.T. = 8 minutes. Allowance = 20%

S.T. = 9.6 minutes

No. of pcs per shift = 50

7. C.M.Gear

O.T. = 9 minutes

Allowance= 20%

S.T. 1.2 x 9 = 10.8 = 11 m

No. of pcs per shift = $\frac{480}{11}$ = 44

8. Hilo sliding gear

O.T. = 9 m allowance = 20%

S.T. = 1.2 x 9 = 10.8

No of pcs per shift = $\frac{480}{10.8}$ = 44

9. Sl.geqr I/II

O.T. = 6 minutes Allowance = 20%

S.T. = 1.2 x 6 = 7.2 minutes

No. of pcs per shift = $\frac{480}{7.2}$ = 66

REWORK IN G1 LINE IN MEDIUM MACHINE SHOP

S.No.	Date/Shift		Machine/Area	Time in hours.
1.	1	A	FN3V-III, FN3H-III	2.5
2.	1	B	RM61-X	8.0
3.	2	B	RM61-VIII	8.0
4.	5	A	RM61-VIII	0.5
5.	5	B	ADDC Rework	8.0
6.	6	B	RM61-VIII, FN3V-III	8.0
7.	8	A	RM61-VIII	8.0
8.	8	A	Shop Rework	8.0
9.	8	A	JF+PTO Milling	8.0
10.	8	B	RM61-VIII	4.0
11.	9	A	RM61-I, Shop Rework	10.0
12.	9	B	RM61-V	1.0
13.	10	A	Shop Rework	8.0
14.	10	B	RM61-I	2.0
15.	10	B	Duplex-III	3.0
16.	11	A	RM61-V	8.0
17.	11	B	RM61-VII	8.0
18.	13	A	Shop Rework	8.0
19.	15	B	RM61-X	8.0
20.	19	B	BVR 3-II	8.0
21.	20	A	RM61-VIII	8.0
22.	20	B	RM61-X	8.0
23.	20	B	FN3V-III, FN3H-I	5.0
24.	22	A	RM61-VIII, H-I	9.0
25.	22	B	BVR3-I	1.0
26.	23	A	Shop Rework	8.0
27.	23	B	Shop Rework	4.0
28.	24	A	Shop Rework	8.0
29.	25	A	Shop Rework	8.0
30.	26	A	Shop Rework	8.0
31.	27	A	G1-241-DH	8.0
32.	29	B	BVR3-II	8.0

TOTAL TIME CONSUMED IN REWORK + 210 HOURS.

REWORK IN G2 LINE IN MEDIUM MACHINE SHOP

S.No.	Date/Shift	Machine/Area	Time in hours.
1.	1 A	RM61 - IV, Shop Rework - S.E.	12 hrs.
2.	1 B	Shop Rework - Spark Erosion	8 "
3.	2 A	BVR-5 SRW	11 "
4.	2 B	RM 61 IV	4 "
5.	4 A	BVR-5, RM61 IV, SRW	18 "
6.	4 B	BVR-5, FN3H IV	16
7.	5 A	Spark Erosion, Shop rework	8 "
8.	5 B	BVR-5	8 "
9.	6 A	RM61-III, BVR 3-III	16 "
10.	6 A	Spark Erosion	8 "
11.	6 B	BVR 3-IV, ADDC R/W	8 "
12.	8 A	BVR-5, Spark Erosion R/W	16 "
13.	9 A	Spark Erosion SRW	8 "
14.	9 B	RM61 - D1/D2 Dowelling	8 "
15.	10 A	ADDC R/W BVR 3-IV, Spark Erosion	16 "
16.	10 B	BVR-5 SRW, Spark Erosion R/W	16 "
17.	11 A	BVR-5 SRW, Spark Erosion	16 "
18.	13 A	G2-DH-242	2.5"
19.	13 A	Spark Erosion	8.0
20.	15 A	Spark Erosion	8.0"
21.	15 B	BVR 3-IV, RM61 IV, Spark Erosion	21.0"
22.	16 A	BVR 3-IV, Spark Erosion	12.0"
23.	16 B	BVR 3-III	4.0
24.	19 A	BVR-5	8.0
25.	19 B	Spark Erosion	8.0
26.	20 A	Spark Erosion, SRW	8.0
27.	20 B	RM61-III	8.0
28.	27 A	Spark Erosion	8.0
29.	23 A	RM-51	8
30.	24A	RM-51, BVR-5	10
31.	25 A	BVR 3-IV, ~~SRWxSparkxErosion~~	8
32.	25 A	Duplex-I, SRW Spark Erosion	16
33.	26A	Spark Erosion, Rwk.	2
34.	26 A	G2 - SH- 242	8
35.	27 A	Spark Erosion, SRW	16
36.	29 A	RM61-IV, Spark Erosion	11
37.	29/B	BVR 3-III, RM X1	16

Total time consumed during rework = 392.5 hrs.

REWORK G1 Tine

Production during month of Feb.88 is as follows:

Transmission Housing	Produced (Actual)
1) G_1 241	622
2) G_1 242/243/352	369

Standard time are as follows

1) G_1 241 - 120.56 minutes = 2.01 hrs.

2) G1 242/243/352-206.91 minutes = 3.45 hrs.

Total output hours =(622x2.01) +(369x3.45)

= 2523.27 hrs.

loss due to rework = 210 hrs.

i.e loss $= \frac{210}{2523.27} \times 100 = 8.3\ \%$

Hence 8.3 % of output hours were lost in rework, thereby lowering productivity by 8%.

REWORK -G2 Line

production during moth of Feb. 88 is as fllows:

Transmission Housing	Produced (Actual)
1) G_2 241	661
2) G_2 242/243/352	347

Standard time for above mentioned components

G_2 241 - 174.53 minutes = 2.91 hrs.

G_2 242/243/352 - 160.87 minutes = 2.68 hrs.

Total output hours =(661x2.91)*(347x2.68)

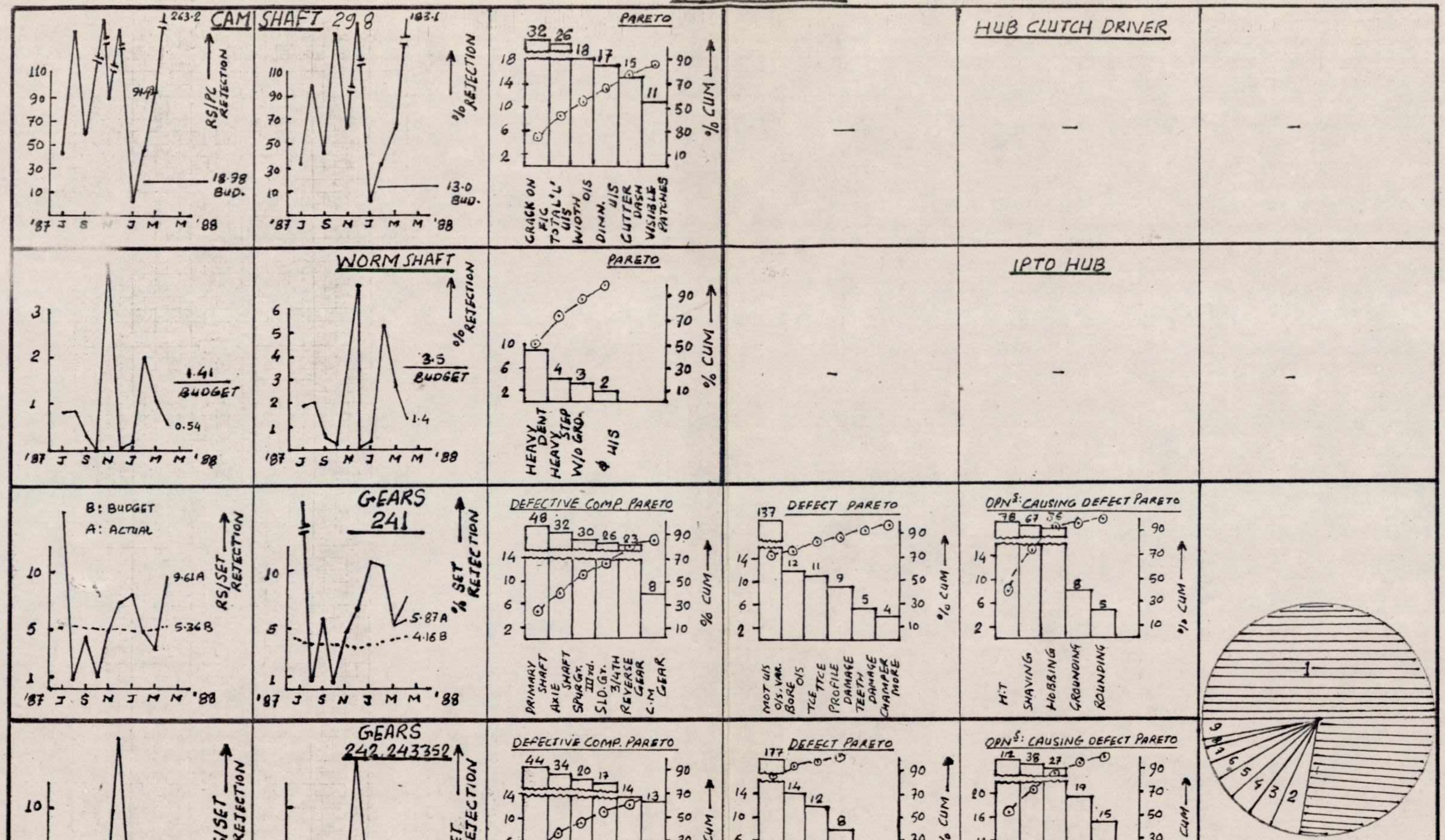
= 2953.47 hrs.

Loss due to rework = 392.50 hrs.

Loss $= \frac{392.50}{2853.47} \times 100 = 13.75\ \%$

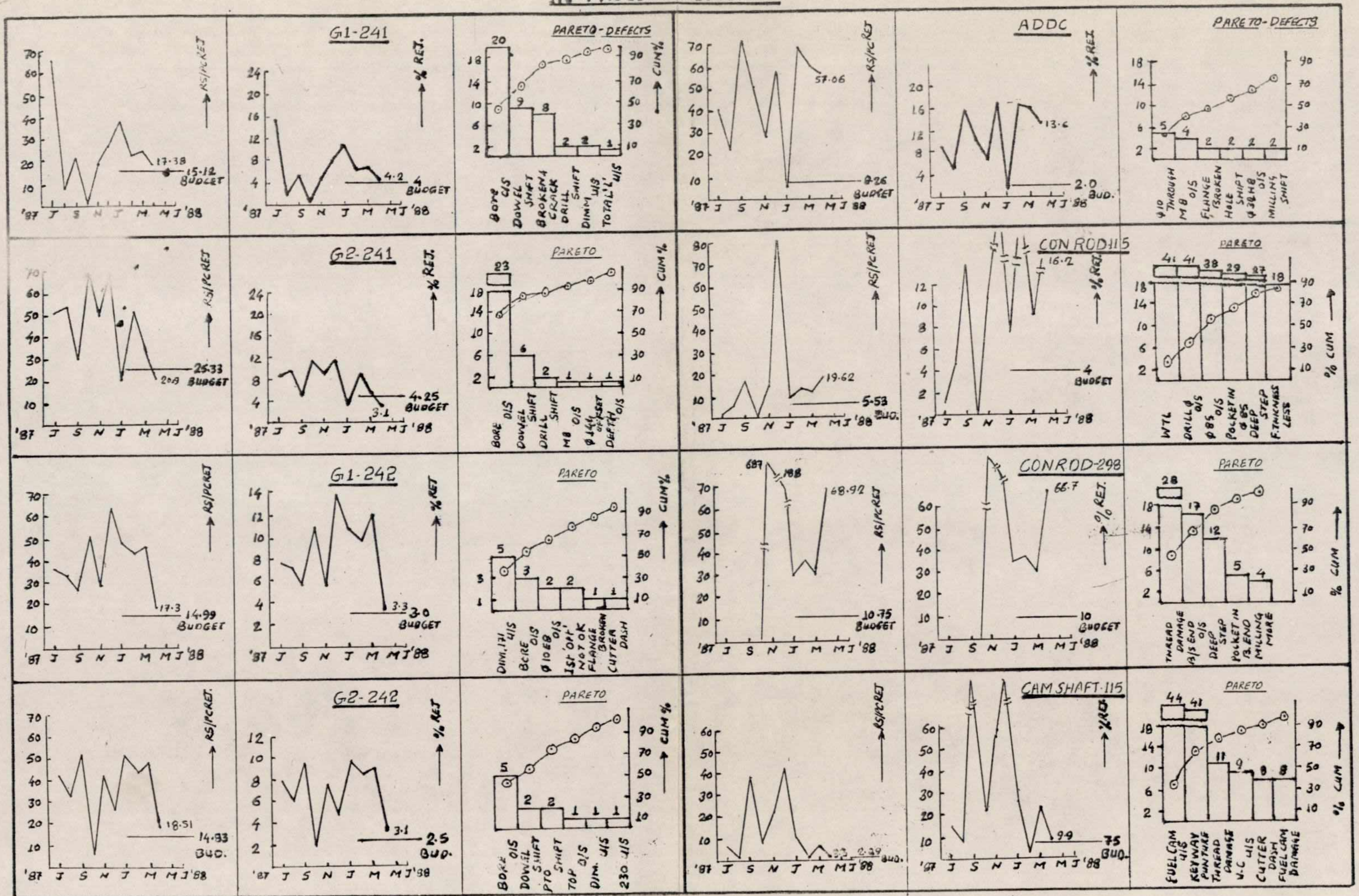
Hence 13.75% of output hours were wasted during Feb.1988 due to rework. This lowered productivity by about 14%.

IN-PROCESS REJECTION



1	2	3	4	5	6	7	8	9	
MOT U/S. O/S & VAR.	WRONG INDEXING	SPLINE DAMAGE	TEETH DAMAGE	BORE O/S	TCE/TTCE	PROFILE DAMAGE	DAMAGE IN H.T	OTHERS	
78	4.2	3.4	3.2	2.9	2.7	2.2	1	2.7	%

IN-PROCESS REJECTION



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MEASURES TO REWORK & REJECTION REDUCTION

Problems frequently encountered in turning and their remedial measures.

Trouble	Probable reason	Remedy
1. Excessive crater wear.	Wrong grades of carbide.	Change over to P grade preferably to lower numbers i.e. having more titanium carbide
	Chip too tight	Increase the chip breaker distance.
	Higher speed	reduce speed.
	Higher feeds	Reduce feed.
2. Edge chipping	Wrong grade of carbide.	Change over to tougher grade.
	Built up edge	Increase the speed. Changer over to harder grade.
	Vibration and or chatter	Reduce tool overhang Change to rigid shank Increase feed, reduce depth of cut. Increase or decrease speed Reduce nose radius Increase approach angle Reduce clearance in toolpost side Check rigidity workholding device Reduce the overhang of tail stock spindle. Tighten tailstock centre Use work rest.
	Wrong geometry	Decrease rake angle. Reduce clearance angle Decrease approach angle
	Cutting edge to s harp.	Hone the edges with a diamond lap
	Brazing stresses in the tip.	Use correct brazing techniques.
	Grinding damage	Use correct of wheel Use correct grinding techniques
3. Tip breakage	Lack of rigidity	Reduce overhang Use rigid shank

Trouble	Probable reason	Remedy
		Use of thicker insert Increase the nose radius Support the work spiece Change to square insert from triangular insert if possible
	Shock due to interruptions.	Use negative rake Change to tougher grade carbide Clean insert pocket case of tools with indexable insert Remove built up edge before indexing Tighten the shim Change the damaged shim Aviod chip breaker play
	Tool holder errors	Too much clamping pressure on the insert Insert seating not flat
	Chip crowding	Increase chip breaker distence Reduce feed
	Wrong assembly	Use negative rake tips only in negative rake holder
4. Insert breaking at the nose.	No support under nose	Change the shim to suit the insert radius Use negative shim in negative holders(Positive rake shims will not give sufficient support to negative rake insert)
5. Tool life too short.	Rapid wear	Change to harder grades of carbide Reduce speed Reduce feed if material is not work harderning type Increase feed if material is work hardening Decrease approach angle Increase clearance Anneal workpiece
6. Poor finish on workpiece	Incorrect geometry	Increase nose radius Use harder grade of carbide
	Marred by chip	Direct chips away from the workpiece (Use angular chip breaker) Use positive back rake
	Incorrect cutting condition	Decrease feed Increase speed Reduce depth of cut Check tool centre height
	Shim radius project-	Use same or larger radius

TROUBLE	Probable reason	Remedy
	ing	shim as an insert
	No relief on cutting edge	Use positive rake insert on positive rake holder

TROUBLE-SHOOTING GUIDE FOR DRILLING

Indications	Causes
Failure of tang	Imperfect fit between taper shank and socket caused by dirt, chips, burrs or badly worn out shanks and shockets
Splitting of the drill at the web.	Insufficient lip clearance Excessive feed Excessive web thinning Careless ejection of drill from spindle causing the drill to fall on the table Striking the drill on the point with hammer (only soft material should be xused for hammer)
Excessive wear of outer corners	Excessive speed Hard spots in material No coolant Cbogging of flutes
Breaking or flattening of ouxter cornoers of drill at flute run off.	Spring or backlash in the drill press and fixture or work
Chipped cutting lips	Excessive feed Excessive clearance angle
Cracks in c utting lips	Overheating or too quick cooling while sharpening or drilling
Breaking of drill	Point improperly gpound Heavy feed Insecure clamping of drill/wok Drill is dull Flute clogged by chips
Hole rough	Po8nt improperly ground dull drill No coolant
Hole oversize	Heavy feed/fixture ax not rigid Unequal angle or length of the cutting edges or both lose spindle
Large ehip coming out of one flute, small chip at the other	Point improperly ground One lip doing all the cutting

TROUBLE-SHOOTING GUIDE FOR BORING

TROUBLE	Probable reasons
Chatter	Lack of rigidity of the bar or spindle Insufficient front clearance angle Too large a nose radius
Poor finish	Worn out tool Low speed Nose radius too small Very high speed
Tool chipping	Cutting edge not sufficiently supported Chatter Interrupted cutting Hard spots or inclusions in material
Edge cracking	Worn out or chipped off cutting edge Improper application of coolant Chatter Low cutting speed
Excessive tool wear	Feed too low Speed too low Incorrect geometry Poor surface finish on cutting edge. Excess dwell in the cut

TROUBLE-SHOOTING GUIDE FOR GUN DRILLING

Trouble	Causes
Faster tool wear	Improper point geometry Insufficient coolant supply Improper alignment Elevated cutting conditions Disproportionate tool overhang Improper grade of carbide(in case of carbides)
Poor surface finish	Improper alignment Low speed Low coolant pressure and improper filtration Chatter Heavy feed rate Incorreect grinding of point Faulty wear pad
Out of round hole	Improper geometrey Misalignment Excessive clamping of the job.

Trouble	Causes
Oversized hole	Worn out bushing Improper geometry Heavy feed
Unsatisfactory chip control	Imperfect fluid system Improper point geometry ~~Heavy~~ High viscosity of coolant Heavy feed rate Low speed Low coolant pressure

TROUBLE- SHOOTING GUIDE FOR MILLING

Problems	Solutions
Chipping of cutting edge	Use tougher carbide Increase speed Hone cutting edge Redeuce feed Use proper geometry
Excessive flank wear	Use harder carbides Hone cutting edge Increase feed Reduce speed Use proper geometry
Excessive crater wear	Use harder carbide Reduce speed Reduce feed
Breaking of carbide	Use tougher carbides Check loose arbor Increase rigidity of the cutter or the machine Reduce number of cutting edges Check whether the machine stalls Increase chip pocket Reduce feed
Chip clogging	Reduce number of teeth Increase chip pockets
Roughtfinish	Increase speed Reduce feed Check axial runout of teeth

Problems	Solutions
Excessive chatter	Increase speed Check losse arbor Increase rigidity of the cutter of the machine. Use proper geometry Try unequal pitch cutters.
Built-up edge	Increase speed Increase feed Select suitable grade of carbide

Trouble-Shooting Guide for Grinding

FAULT	CAUSE	MEANS OF RECTIFICATION
Wheel wearing out too fast.	Wheel is too soft.	Use harder wheel
	Grinding wheel speed lower than that recommended	Increase the wheel speed to the recommended value
	Wrong rate of traverse of work speed	Reduce the rate of traverse and work speed and decrease slightly the depth of cut
Wheel glazing	Wrong selection of wheel	Use softer wheel or coarser grit
	Wrong traverse and work speed	Reduce speed to the recommended minimum
	Incorrect dressing.	Keep the wheel sharp by using a sharp diamond Use fast traverse and a grater depth of infeed.
	Depth of cut	Increase depth of cut
Chatter marks	Wheel out of balance.	Rebalance the grinding wheel after running off excess coolan
	Incorrect dressing	Use proper deressing tool While dressing, the tool should not be held firmly against the wheel
	Wheel too hard	Select softer grade or coarser grit wheel
	Machine vibration	Check bearings and foundations Check motor for balance. If necessary, adjust spindle bearings.

Fault	Cause	Means of rectification
	Loose pully on spindle	Tighten pully
	Work piece ~~k~~ vibrating, whipping or not freely revolving.	Use suitable supports of clamps for long and large job.
		Check alignment of centres and provide adequate lubrication reduce work speed and infeed.
Coarse finish	Wheel too coarse Wheel too soft.	Use finer wheel Use harder wheel
Wheel loading	Wrong selection of grit and or grade.	Use softer or rougher wheel havir porous structure
	Wrong dressing	Use a sharper dresser. Pass the tool quickly across whee face. Wash freshly dressed wheel with good flow of coolant before commencing grinding.
	Dirty and insufficient coolant.	Use a copious quantity of coolant which must be clean and free from dirt.
Irregular marks of different lengths and width	Dirty coolant	Clean the tank. Change the coolant. Use proper filter.
Deep irregular ~~mm~~ marks.	Loose wheel flanges.	Tighten the wheel flanges. If necessary place fresh blotters or lead washers.
Overheating of job ground discoloration.	Wrong selection of grinding wheel.	Choose a softer wheel or manipulate the wheel so that it has an apparant softer cutting action.
		Increase the volume of coolant flowing over the wheel and the component.
		Take effective steps to aviod chatter glazing or loading.
Spirals on work during centreless grinding.	Wheel not cutting in havily on front or back of wheel width.	Dressing grinding wheel so that that the cutting portion is relieved by 12 to 22 mm on either edge of the wheel width
	Regular wheel width and work support plates are not parallel with work contact line.	Line up guide plates with lining bar of approximately same diametre as workpiece being ground
		If guides are parallel and wheel dressed, increase regulating wheel housing angle $\frac{1}{2}^{\circ}$ more than regulating wheel truing device angle.

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INCORRECT BOOKING

The nubmer of pieces machined or worked upon by an operator are recorded by supervisor during a shift. The record is called Daily production Report . This report is used for calculating output hours and Incentives. It is assumed that entries machine these reports are right and precise. But actually itmay or may not be so. If production according to Daily Production Reports and figures from Production circular, P.P.C report S.M.T.Ns and rejection summary are matched, results differ.

The exercise of finding this difference or of cross checking the truthfulness of Daily Production Reports is called incorrect Booking.

Incorrect Booking gives idea about the pieces which are missing or unreported or unattended. This exercise gives idea about wrong entries ~~gkxxxkdxx~~ made by supervisors or wrong information conveyed by worker. The final difference gives number of wrongly booked or unexplained pieces.

STEPS FOR AVIODING INCORRECT BOOKING

1) Daily production reports should be filled with utmost accuracy after physical verfication of pieces.

2) Operation wise W.I.P. should be recorded so as to facilitate the

undertaking of this exercise. Moreover W.I.P. will give clear picture of production at any moment.

3. Information about the pieces machined or worked upon should be complete e.g.

i) In case of N.S.T., number of pieces produced during a shift are hardly mentioned and as such problem of quantity flowing arises.

ii) Entries are ambiguous. One cannot differentiate between G 241 and G 352 as entry is G/241/352. Exact quantity of each item machined is not known.

INCORRECT BOOKING IN CASE OF G2 - 241

S.No.	Operation	"PRODUCED" Oct.	Nov.	Dec.
1.	Top face milling	740	718	757
2.	Bottom Face Milling	694	733	694
3.	Top face dowelling	694	774	792
4.	J.F./P.T.O.Milling	696	753	766
5.	D1/D2 face milling	715	952	779
6.	T/B drilling	713	910	618
7.	D1 side drilling	642	1004	722
8.	D2 side drilling	650	906	526
9.	P.T.O.face drilling	707	921	768
10.	JF/D/DT	686	800	775
11.	Tapping all sides	639	865	603
12.	Boring S.H.	706	813	764
13.	Boring D.H	690	834	741
14.	Circlip Grooving ∅72	806	1381	1227
15.	Circlip Grooving ∅100	818	1162	720
16.	Counter Boring	670	754	583
17.	Drilling & Reaming 10H7	723	985	696
18.	Drilling & Reaming ∅60	698	900	488

	Oct.	Nov.	Dec.
Produced	405	785	552
Rejection	47	68	65
WIP	371	234	283

G2 - 241 :

First operation i.e. top face milling was done on = 740+718+757
= 2215 pieces.

No. of finished pieces in 3 months is = 405+785+552
= 1742

Total Rejection = 180

WIP at end of December = 283

Unreported pieces = 2215 - 1742
-180
= 473 - 180 = 293

Difference = unreported pieces - W.I.P. = 293 - 283 = 10

Therefore missing number of pieces or the wrongly booked pieces in three months is = 10

INCORRECT BOOKING IN CASE OF INTERNAL GRINDING
ON WMW IN JANUARY, 1988

Date/ Shift	Components name	Code no.	No. of components	Idle time
6A	Spline Shaft	01	100	2 hrs.
12-A	Sliding Gr. Ist.	-	-	-
12-B	Sliding Gr. Ist.	01	60	1.50 hrs.
13-A	Sliding Ist.	-	125	-
13-B	Sliding Ist.	-	26	-
13-C	Sliding Ist.	01	55	1.50 hrs.
16-B	Intermediate shaft	01	10	2.50 hrs.
16-C	Int. Shaft	-	10	-
18-A	Int. Shaft	-	18	-
19-A	Int. Shaft	-	106	-
19-B	Int. Shaft	06	135	No power
19-C	Int. Shaft	-	120	-
20-A	Int. Shaft	-	45	-
22-C	Primary shaft 242	01	75	2.50 hrs.
23-A	Primary shaft 242	-	219	-
23-B	Primary shaft 242	-	-	-
24-A	H/L Cluster Gear	01	10	4 hrs.
24-A	H/L Cluster Gear	-	40	-
24-B	H/L Cluster Gear	-	110	-
25-A	H/L Cluster Gear	-	97	-
27-A	H/L Cluster Gear	-	17	-
27-B	H/L Cluster Gear	-	115	-
27-C	H/L Cluster Gear	-	83	-
28-A	Sldg. 5/6th	01	1	2.50 hrs.
29-B	Spline shaft	-	26	-

S.No.	Component	PRODUCED			WIP(HARD)			REJECTION			Ground	Unground
		Dec.	Jan.	Feb.	Dec.	Jan.	Feb.	Dec.	Jan	Feb.	on 1-3-88	
1.	Primary shaft - 242	528	510	171	75	47	40	19	11	41	23	17
2.	H/L Cl.Gear	517	450	162	119	98	154	122	7	23	18	136
3.	Spline shaft	658	206	376	85	375	242	3	16	42	3	239
4.	Sld.Gr.Ist.	204	209	237	12	2	62	4	22	-	19	43
5.	Int.Shaft	460	396	475	71	67	21	42	18	49	16	5

		Internally Grinded			Total Grinded	Produced	Rejected(	Hard)	WIP
		Dec.	Jan.	Feb.					
1.	Primary Shaft - 242	670	459	220	1349	1209	71	(62)	40
2.	H/L Cl.Gear	636	472	213	1321	1129	152	(152)	154
3.	Spline shaft	692	126	387	1205	1240	61	(42)	242
4.	Sld.Gear Ist.	188	266	251	705	650	26	(6)	62
5.	Int.Shaft	556	444	548	1548	1331	109	(91)	21

S.No.	Component	Internally Grinded in 3 months	Produced	Rejected (Hard)	Actually Ground	Actually Reported	Unreported pieces
1.	Primary Shaft-242	1349	1209	62	23	1294	55
2.	H/L Cluster	1321	1129	152	18	1299	22
3.	Spline shaft	1205	1240	42	3	1285	0
4.	Sld.Gear Ist.	705	650	6	19	675	30
5.	Intermediate shaft	1548	1331	91	16	1438	110

* Actually Ground = W.I.P (Hard) on 1.3.88
* Actually Reported= Produced + Rejected (Hard) + Actually Ground
* Unreported pieces= Internaly Grinded - Actually reported

Unreported pieces are either missing or incorrectly booked - According to above data (as per daily production reports, SMTNs, Production circular) unreported pieces indicate wrong booking on part of worker/supervisor.

PROJECT NO. 2

WORK SIMPLIFICATION

IN

M.M.S.

MATERIAL MOVEMENT

1. In G1 line

ADDC S.PM Boring machine and Horizental milling machine share a common table. Space is very less and as such loading and unloading consume much time and effort.
Each machine should have a separate table where products can be kept easily and material handling will be okay.

2. Floor/aisle is neither smooth nor clean. This makes the movement of trolleys inconvenient and jerky. Due to lack of proper floor material movement consumes about 20% of machine time per job. Morevoer a no. of pieces are damaged e.g. breaking of flange.

3. Due to lack of space near cross lift loading and unloading of G 1 and G 2 components becomes more time consuming and effort consuming. Moreover G 1 components share a single table and as such problem of loading and picking a particular component increase. The pieces lying close to aisle are placed while those near supply store are left unattended. Space for trolley movement is very less.

4. Crosss lift is not used so as to save time. Compenentsar e picked up and kept mercilessly on one another. This results in flange breaking.

5. About 3 machines share 1 hoist and as such material movement ,handling large time.

No. of trollys should be equal to No. of milling machines + $\frac{\text{No. of other machine}}{3}$

6. For fixed abd horizental paths, material shold be moved by hand or gravity. Gravity chutes and slides should be

encouraged.

In case of single boring head machines in G 2 section chutes should be provided

These were provided.

MATERIAL HANDLING

Study of material Handling includes moving of raw materials from receiving stores through production processes to the packing of final production most efficient by safe manner so as to produce and achive higher productivity at a minimum handling cost.

1) GRAVITY OPERATED chutes are most economical and should be used wherever possible.

2) Material should be moved the shortest route.

3) Use of fork truck should be encouraged.

RECOMMENDATIONS FOR MATERIAL MOVEMENTS

ENGINE

Perkins P4(I) or Cooper MVC-4(I) Industrial, 4 Cylinder diesel engine 3.14 litres (192.4 cubic inches) piston displacement, maximum torque continuous rating 16.3 Kg.m. (118 lbs. ft.) at 1400 rpm. The complete assembly is supported on rubber mounts. Balanced crankshaft for smooth operation. Full flow oil filter for filtering lubricating oil, and vertical exhaust.

FUEL AND COOLING SYSTEMS

Injection pump with a pneumatic governor, atomisers efficiently cooled, engine equipped with oil bath air cleaner, oil and water pumps. Fuel tank removable 'droptype . Protectoseal tank cap equipped with strainer. Fuel tank capacity 40 litres ($10\frac{1}{2}$ US gallons.) Pressurised cooling system for cooling efficiently. Large diameter pusher type fan for efficient cooling.

DRIVE

Fluid coupling drive—exclusive fluid coupling between engine and 280 mm clutch provides cushioned drive without metal to metal contact. Starting slip takes place in coupling, greatly prolonging clutch life. Coupling eliminates use of clutch pedal when stopping and starting. Two speeds forward and reverse provide full range of torque requirements. Floor mounted stick shaft eliminates complicated linkages and wear points.

ELECTRICAL SYSTEM

Electrical system with colour coded wiring. System includes 12 volt battery, equipped with belt driven generator and axial type starter motor.

BRAKES

Heavy duty truck type hydraulic brakes are self adjusting. Brake lining is bounded to all steel shoes. Fully hand adjustable manually operated parking brake is mounted on the cowl. Braking is direct at wheels. Brake master cylinder is protected but readily accessible in operator's compartment.

HYDRAULIC SYSTEM AND CONTROLS

Hydraulic tank incorporates breather filter to prevent contamination of system. Balanced vane type hydraulic pump is driven from the front end of the crankshaft through flexible coupling. Control valve located on driver's right provides easy operation of lift and tilt functions. Valve has built-in relief valve which protects hydraulic system against excessive pressures due to overloading. A 25 micron filter in the hydraulic circuit protects the system from dirt and increases life of the pump, control valve and cylinders. Large bore double acting tilt cylinders provide smooth, rigid tilting action.

MAST, CARRIAGE AND FORKS

I-beam mast construction provides maximum rigidity; nested for optimum visibility. Uprights and carriage are guided by widely spaced integral load rollers mounted on precision bearings and 4 widely spaced fully adjustable side thrust plugs. Carriage is arranged to accept a wide range of attachments. Forks are heat treated.

DRIVE AXLE

One piece axle housing employs hypoid ring gear and pinion. A 4-pinion differential transmits power smoothly through involute spline full floating drive shafts. Rugged pinion design withstands the stress of repeated tight turns. All gears operate in common oil bath.

STEERING

Power steering is standard. Steering gear is cam and lever type for efficient steering action. 457 mm diameter steering wheel is mounted at proper angle assuring maximum driver comfort. Articulating steering axle provides full four wheel contact even on uneven floors. Centre point steering geometry provides minimum uniform steering effort in both directions. Steering tie rods are mounted high in frame for maximum ground clearance.

INSTRUMENTATION

Standard five-gauge operator's panel contains fuel, oil pressure and water temperature gauges; ammeter and engine hour meter are electrically operated, and are mounted in protected instrument panel to shed water.

FRAME HOOD AND COWL

Frame is fabricated of heavy gauge bar and plate steel, electrically welded into a unit structure. Easily removed hood and floor plate permit maximum accessibility in minutes. Heavy guage cowl provides maximum operator protection. Instruments are mounted in a protective housing on top of cowl.

TYRES

Pneumatic Tyres:
Drive 2 Nos—7.00 x 12—12 Ply
Steer 2 Nos.—6.50 x 10—10 Ply

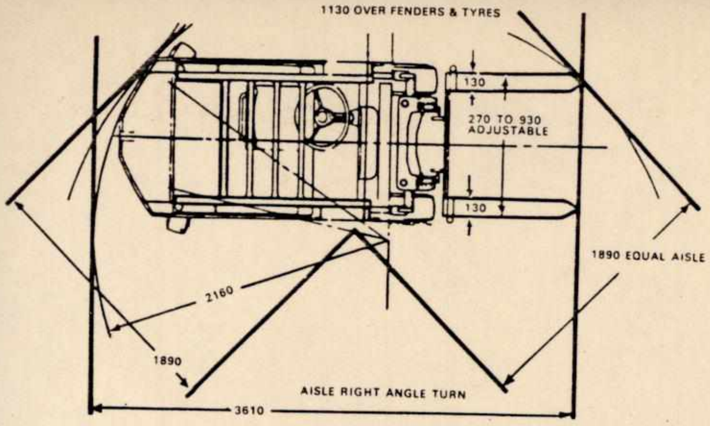
Cushion Tyres:
Drive 2 Nos—7.00 x 12
Steer 2 Nos.—6.50 x 10

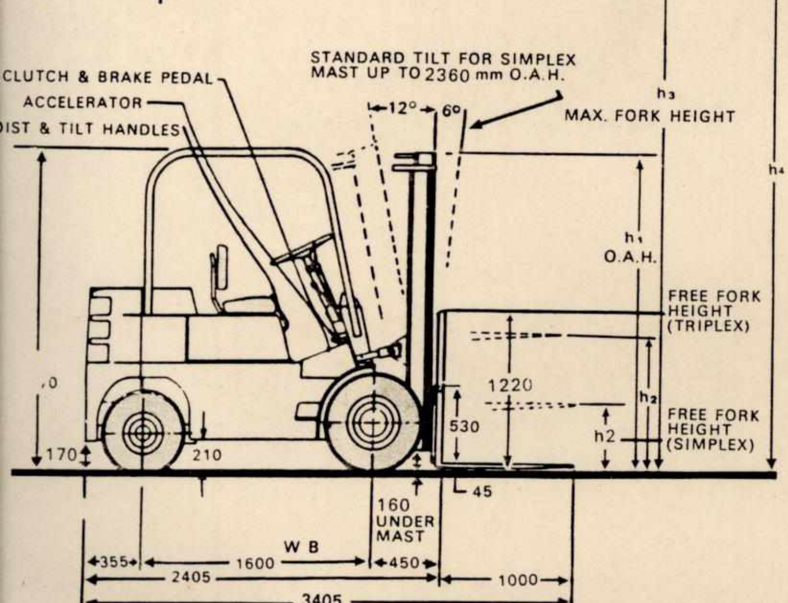
Solid Tyres:
Drive 2 Nos.—26" x 7" x 20"
Steer 2 Nos.—22" x 6" x 16',

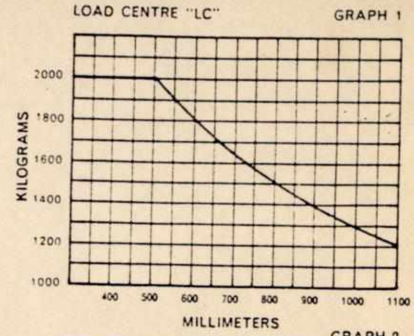
GENERAL

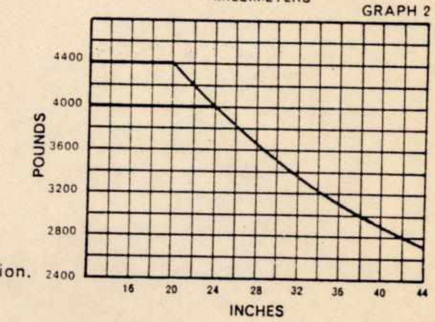
Wheel—Easily removed; all mounted on tapered roller bearings.
Electric Horn—Activated by button.
Lubrication—All critical friction points equipped with standard high pressure lubrication fittings.
Paint—Traffic Yellow
Seat—Engineered for operator comfort, adjustable by 100 mm (approx.)

Overhead canopy guard is mandatory.









Load Capacity Chart
Based on mast in vertical position.
(For Simplex mast)

Mast			Simplex
Diesel Engine			Perkins P4 (I) or Cooper MVC-4 (I)
Lift speed	m/s	Laden	0.34
		Unladen	0.37
Lower speed	m/s	Laden	0.46
		Unladen	0.36
Travel speed	km/h	Laden Unladen	16.4
Weight (With 2360 mm simplex mast)	kg	Laden	5575
		Unladen	3575

Note: Following changes in Dimensions with Triplex mast

- Front over hang 480 mm
- Overall length without forks 2435 mm
- Equal aisle 1920 mm
- Aisle right angle turn 3640 mm

Lift Specifications—Simplex Mast—Single Front Tyres															
O.A.H. h_1		Free Fork Height h_2		Max. Fork Height h_3		O.A.H. at Max. Fork Height with Load Back Rest h_4		Fork Spread with Load Back Rest		Tilt		Capacity at 24 inches Load Centre	Capacity at 500 mm Load Centre
Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Fwd	Back	lb	kg
74	1880	16	405	106	2690	154	3910	36$\frac{5}{8}$	930	6°	12°	4000	2000
93	2360	16	405	144	3660	192	4880	36$\frac{5}{8}$	930	6°	12°	4000	2000
Lift Specifications—Triplex Mast—Single Front Tyres*													
74	1880	45	1145	156	3960	204	5180	36$\frac{5}{8}$	930	3°	6°	3900	1960
93	2360	54$\frac{1}{2}$	1385	213	5410	261	6630	36$\frac{5}{8}$	930	3°	6°	1500	680

*Dual tyre execution on application.

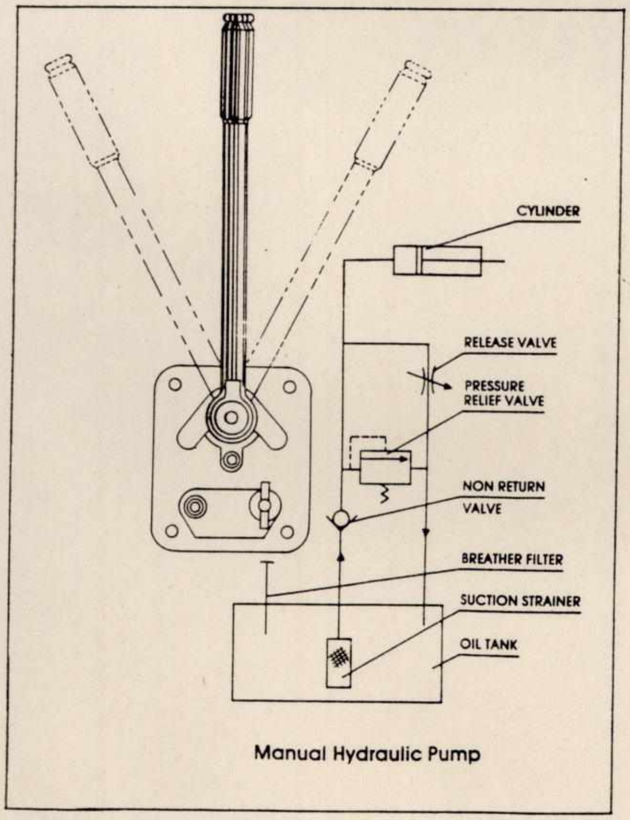
Dimensions are in millimeters/inches and are subject to change without notice.
Dimensions/speeds are subject to variation of ± 12%.

All lifting tables feature a heavy duty platform with deep side skirts to give minimum distortion. The base frame is robust in construction and is suitably braced to withstand twisting moments. For higher capacity models, the cylinders are mounted between the scissors legs, to eliminate distortion in the base frame. A deep section scissors profile reduces bending. In some models, these are fabricated from hollow box sections, offering more torsional rigidity and yet being light in weight.

HYDRAULIC SYSTEM: Two types of hydraulic systems are offered, i.e. Manual Hydraulic and electro-Hydraulic system. In both cases, the power pack consisting of the oil tank, hydraulic valves and pump is mounted on the chassis of the equipment. The manual hydraulic pump as well as the hand lever controls of the electro-hydraulic system are both fitted on the chassis. In case, push button electrical controls are desired, then these may be fitted, either on the chassis, or on the platform itself, or at any other remote place, separate from the equipment.

MANUAL HYDRAULIC SYSTEM: This consists of a **'DOWTY'** make double acting hydraulic pump, with a built in **overload safety valve** and a precisely controlled, **screw type lowering valve.** Lift is obtained by working the ram pump handle. The lowering can be controlled infinitely by opening the screw type valve.

The robust and easily maintained hydraulic pump gives a long life of trouble free service. **Two hardened steel pistons,** operating in **cast iron cylinders** create pressure at each stroke of the handle. A special feature, which considerably facilitates maintenance, is that the pistons have **no rubber seals.**

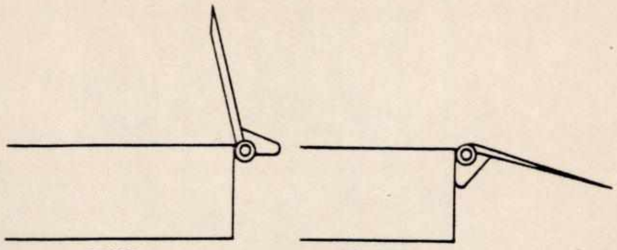


Manual Hydraulic Pump

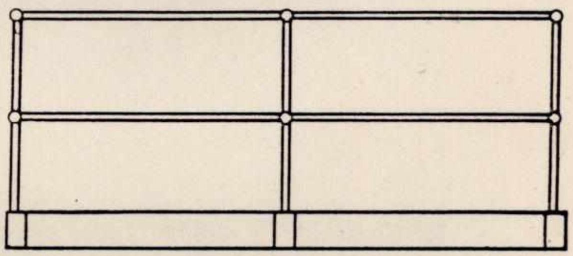
SCISSORS

ACCESSORIES & SUPPLEMENTARY ITEMS

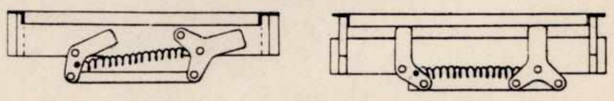
1. KICK OVER FLAP: A kick over flap fitted to the edge of the liftable platform allows any gap between the platform and the adjacent surface to be easily bridged. The flaps fold approximately 15° over the vertical and downwards 15° below the horizontal and may be of any practical width.



2. TUBULAR HANDRAIL: A handrail may be fitted to the platform of any liftable, and can be supplied as, either fixed members' or as hinged members. All handrails are easily removable from the platform. The standard height of the handrail is 900 mm.



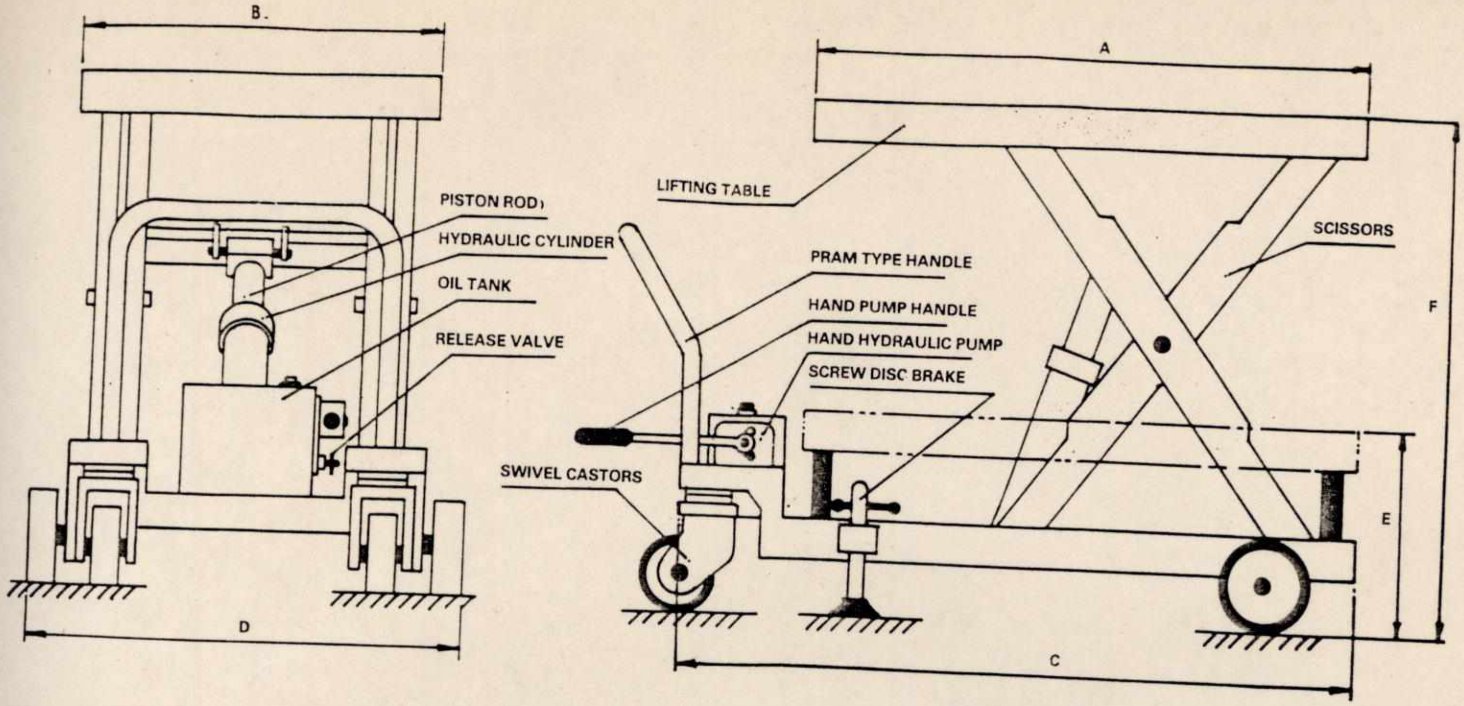
3. BAR WHEEL STOP: If a wheeled truck is raised on a liftable platform, it is advisable to fit a wheel stop across one edge. The stop comprises of a bar, which protrudes above the platform surface as the platform rises and automatically retracts flush, when the platform reaches its lowest position. It is not possible to retract the bar when the platform is raised, due to a geometric lock in the linkage. Fitting a bar wheel stop to a standard platform extends the platform length by about 100 mm.



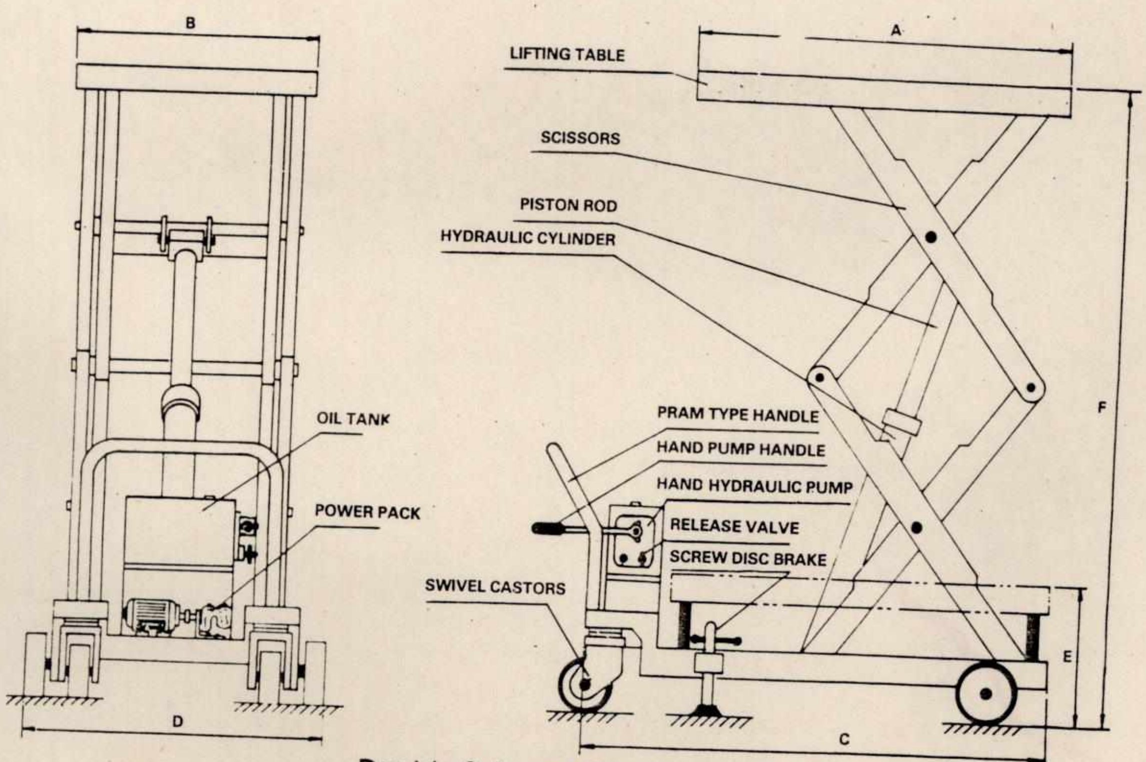
4. ROLLER TYPE PLATFORM: The platform table can be fitted with rollers instead of a flat plate. Rollers may be in a single row or double rows. The rollers fitted onto the platform increase the closed height as well as the elevated height of the equipment by about 100 mm.

OTHER HULK PRODUCTS

- HYDRAULIC PALLET TRUCKS
- HYDRAULIC FLOOR CRANES
- HYDRAULIC STACKERS

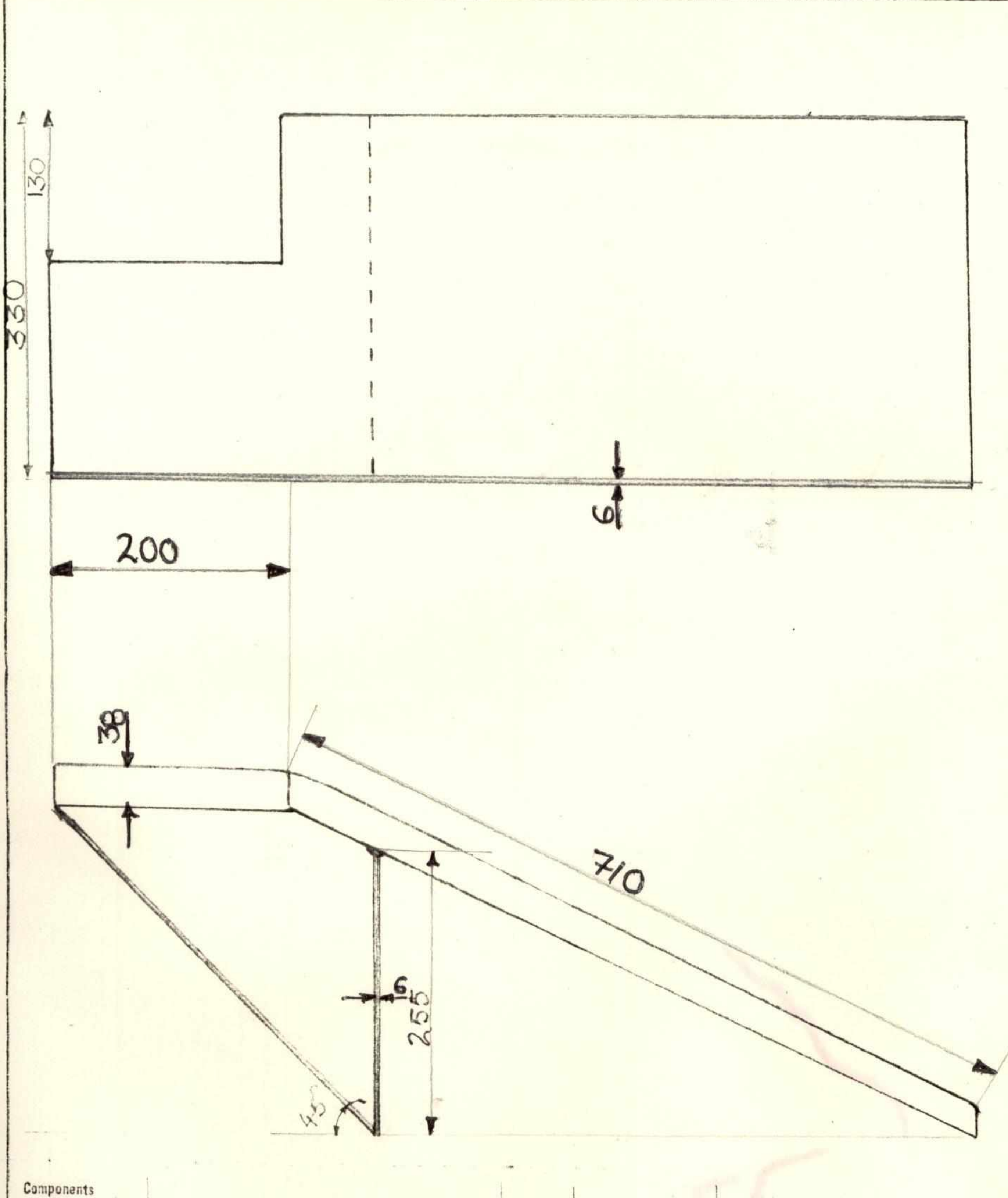


Single Scissors (SS) Liftable



Double Scissors (DS) Liftable

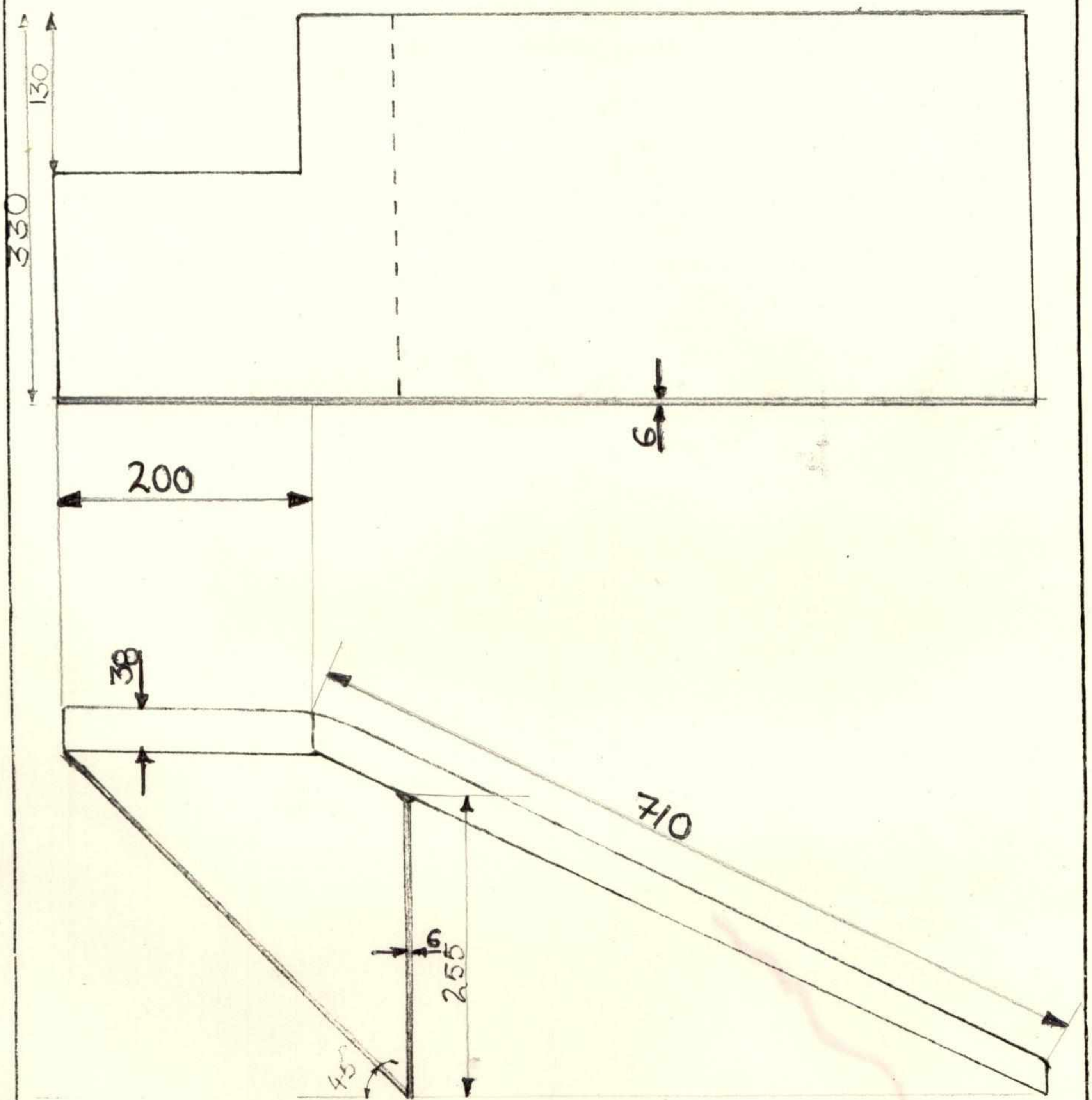
EICHER GOODEARTH PARWANOO TOOL DESIGN DEPTT.	GRAVITY CHUTES FOR SINGLE HEAD BYRING M/CS	REFERENCE



Components				
Parts List Example	CHUTE	—	M.S.	—
	Designation	Item	Material	Remarks/Stock No.

DRN. Aku Upal	Alterations	DRG. NO.
CHD.		AKU-2
APPD.		
DATE [illegible]	(1/5)	

EICHER GOODEARTH PARWANOO TOOL DESIGN DEPTT.	GRAVITY CHUTES FOR SINGLE HEAD B/RING M/cs	REFERENCE



Components				
Parts List Example	CHUTE	—	M·S·	—
	Designation	Item	Material	Remarks/Stock No.

DRN. Akul Pal	Alterations	DRG. NO.
CHD.		AKU-2
APPD.		
DATE 14-3-88		

CLAMPING AND UNCLAMPING
AND
LOADING AND UNLOADING

It is obserrved that during loading and unloading a lot of time is lost and same is the case with clamping and unclamping. If jigs and fixtures are properly designed this time can be reduced. By designing more appropriate and less time consuming jigs we can reduce the non productive time. Following are some suggestions which were forwarded,

1) On machine FN3H, new milling fixture can be designed. This will hold job by 2 clamps rather than 4 clamps. Thus shortening the loading and clamping time. Productivity will be enhanced as effort during clamping and unclamping will reduce to half of the present.

   Two brackets should be erected midway between present Brackets and clamping should be done on these. Thus decreasing the number of clamps from 4 to 2.

   This will reduce unproductive time. Moreover mantime will be reduced.

2) On machine FN3h, D1/D2 side milling 2 clamps will be sufficient instead of 3 clamps. Locating of job will become easier in case of two clamps. This will definitely increase productivity.

3) Drilling jig for G_1 top side should be modified alongwith clamping part. In this case, C washer can be used for clamping purpose instead of 4 clamps . Location of job, clamping, loading and unloading will become safe and convenient. Moreover about 50% unproductive time will be reduced.

4) Keys and spanner should be left in position if these are non interfering. This will eliminate following elementary movements and save time and effort.

1) Search 2) find 3) Select 4) Transport 5) Position

6) Assemble 7) Disassemble 8) Release load 9) Transport empty

The cycle will be as follows

Grasp - Use - Preposition -Rest

5) In case of all drilling and tapping operations the position of tools should be fixed with respect to work table. This facilitate the operation as operator h s no need to search for tools. Moreover the drills reamers and other tools should be placed in order of their turn or in sequence. Tools should be in opertaors reach.

By fixing the position of tools f ollowing elements are eleminated:

1) Search

2) Find

3) Select.

Thus in case of drilling, Reaming and tapping loading and unloading of tools bec omes easier and conivenient.

STUDY OF SEQUENCE OF ELEMENT S

OPERATION -DRILLING

Sr.No. Elements

1) Helper keeps the job on the table.

2) Operator shifts the job and brings out the working face.

3) Operator picks up the jig.

4) Operator rests the jig on job.

5) Operator fixes the jig on to the job.

6) Operator searches for clamping devices, picks it and starts clamping the jig.

7) Operator pulls the piece towards himself and locates the job space.

8) Sets the feed, depth. R.P.M.

9) Searches for drill, picks it up.

10) Fixes drill in the collet/spindle.

11) Brings the drill rapidly down wards.

12) Locates the hole.

13) Drilling is done.

14) Drilling is brought upwards.

15) Machine is switched off.

16) Drill is taken off.

17) Kept on table.

18 Searches for other drill/tool, picks it up and again repeates the steps from Sr.No. 10 to Sr.No.18.

19) Unloading.

Elements corressponding to Sr.No.2,3,4,5,6,8 and 9 are not required. The helper can be asked to keep the job in proper manner to pick the

2nd jig and rest it on the piece and clamp it properly.

During the time the operator can remove the Ist jig and unload the job. Position of tools should be fixed inorder to eleminate Sr.No.9

INSPECTION IN EICHER

To ensure that a complete check is kept on the quality of purchased parts, materials, equipment and manufacturing accuracy at all stages in production, the quality department has been organised to perform the following functions :-

1) Raw Material Inspection
2) Inspection of bought out parts and sub-contracted parts.
3) Checking of parts made in the factory
4) Inspection and test of finished part/products.
5) Gauge or instrument inspection
6) Tool Inspection.

RAW MATERIAL INSPECTION

Procedures for incoming material inspection vary considerably with the types of materials used and the quality standards specified. Generally following checks are made :-

i) Dimensional check
ii) Test of physical properties like tensile strength, compressive strength, ultimate strength, hardness etc.
iii) Chemical composition is verified.

Usually one/two samples are inspected from each batch of material received.

INSPECTION OF BOUGHT-OUT AND SUB-CONTRACTED PARTS

These parts are checked for :-

i) Dimensional accuracy
ii) Physical properties like hardness and strength

Dimensional inspection may sometimes be on all the parts received but generally only a percentage of the batch is checked.

...2....

CHECKING OF PARTS MADE IN THE FACTORY

Controlling the quality of all parts manufactured in the factory usually represents the largest and most difficult function of a quality control department. It is affected considerably by the type of manufacture and by the quantities produced. For batch production, there are main methords :-

i) Viewing the first components off the new 'Set up' and then sample periodically from the running job with or without reference to a statistical quality control chart.

ii) To sample from the completed batch.

iii) To view all the completed parts. This is time consuming and is not normally used ~~x~~ unless the process is performed under conditions of marginal accuracy with the possibility of a high percentage of rejects.

Continuous production methods obviously demand a continuous form of inspection and where type production is used it is usual to station inspectors at ~~specific~~ specified stages in the manufacturing process. Unnecessary ~~inspections~~ inspections operations should be eliminated as they increase the cycle time and hence cost of production.

Apatrol viewer should be employed to sample components coming off each operation. This type of inspection is useful when new operations are being trained, as it allows added concentration on trouble-spots and often leads to a considerable reduction in scrap and work requiring rectification/rework.

Increasing emphasis is being placed on operators checking their own work, it help to relieve monotony, it creates a new ~~pride~~ pride in the work, it develops a feeling of quality-consciousness and leads to a reduction in the amount of scrap/rejection and work needing rectification/rework.

Operator inspection canoften be performed during the automatic cycle time of the machine if this can.not be arranged an appropriate increase in the allowed time for the job must be made.

It is feasible that automatic measurements could be used to provide a certain amount of adjustment to tool settings, thereby further eliminating the xxx need for a setter, except to replace or re-grind worn tools.

INSPECTION AND TEST OF FINISHED PRODUCTS

The quality check as finished products is of improrbance since it is the last chance of finding imperfections that may render the product unsuitable to the customer. This final inspection takes two forms which may be performed simultaneously. The first is a visual check to ascertain if the appearance is to standard, and may include a dimensional check.

The second is a functional test to ensure that the product performs to specification.

GAUGE INSPECTION

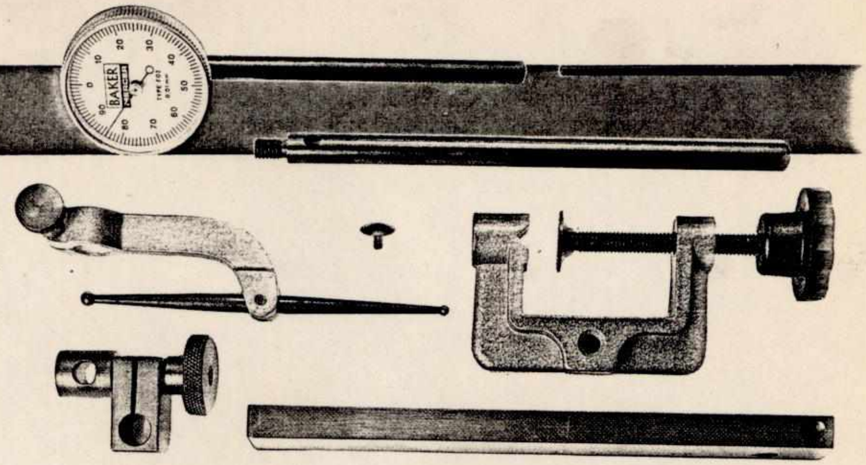
It parts are to be made to a required standard of accuracy the measns of checking these parts must themselves be maintained to a high standard. Generally, the tolerance on the accuracy of gauges is about 10 percent of the components tolerance. Periodic examination of gauges is necessary. New gauges must be examined to ensure they have been accurately made. This work is usually done in a standards room where conditions of temperature are closely controlled at 20° C to eliminate expansion errors.

....4....

TOOL INSPECTION

The purpose of tool inspection is not so much to check the accuracy of tools against their drawings as to ensure that they are safe, ~~xxxxx~~ functionally sound and will produce a component within the specified tolerance. A frequently used method of ~~xxxx~~ checking consists of an inspection of sample components made from the tools.

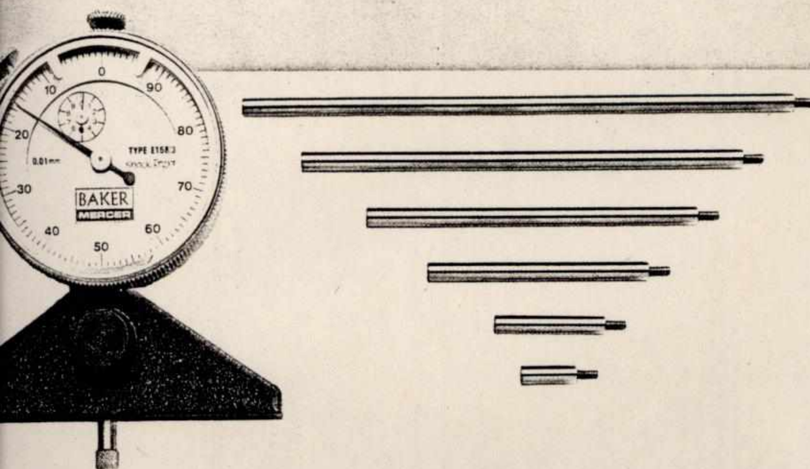
UNIVERSAL TEST SETS



- Versatile combinations for various gauging applications.

TYPE	READING	RANGE	GRADUATION
UI01	0.01 mm	2.0 mm	0-50-0
UI02	0.01 mm	2.0 mm	0-100
UI51	0.001 in	0.1 in	0-50-0
UI52	0.001 in	0.1 in	0-100

DEPTH GAUGES

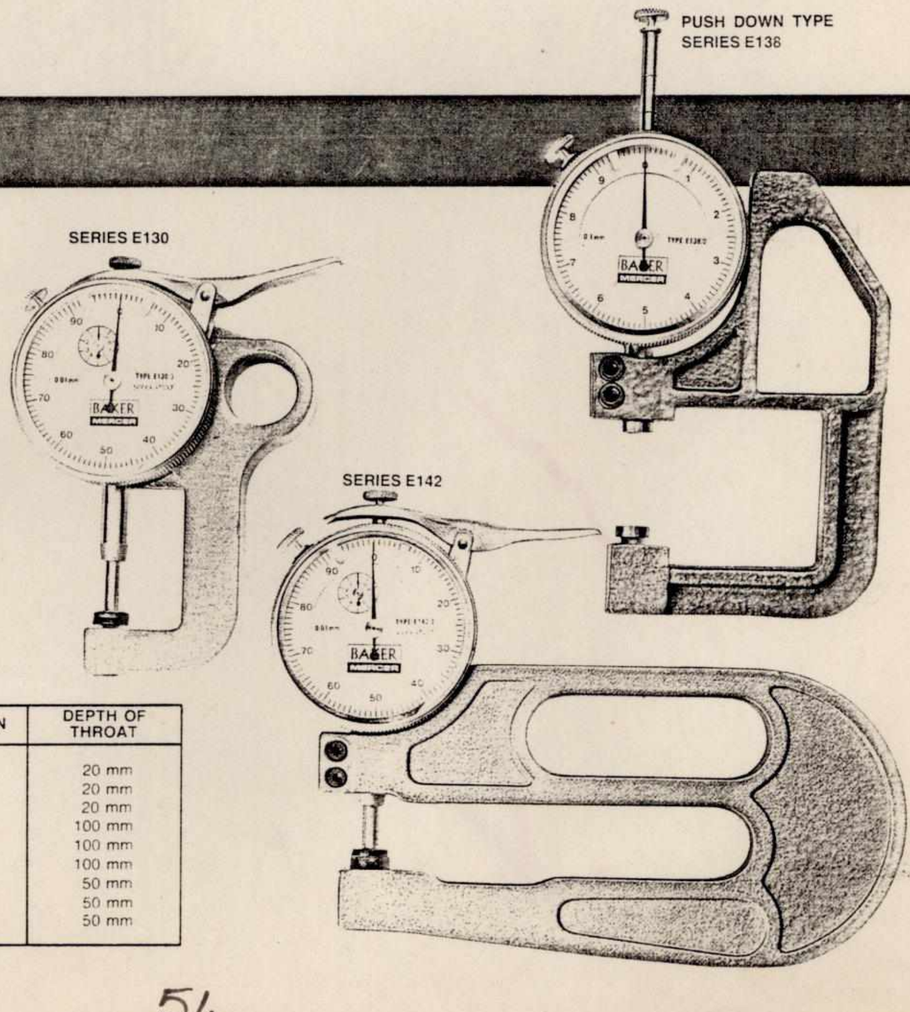


- For convenient and rapid measurement of bore depths.
- Base length 80 mm.

TYPE	READING	RANGE	GRADUATION
E158/0	0.1 mm	0-200 mm	10-0
E158/3	0.01 mm	0-200 mm	100-0
E158/1	0.001 in	0-8 in	100-0

THICKNESS GAUGES

40


PUSH DOWN TYPE SERIES E138

SERIES E130

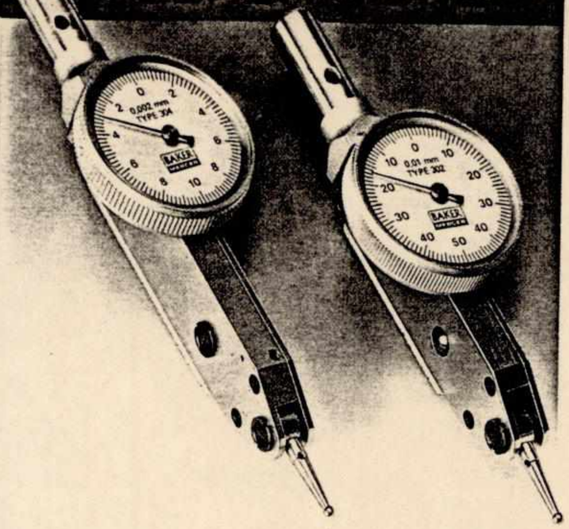
SERIES E142

- For rapid thickness checks.
- Supplied with 10 mm Flat Anvils.
- 20 mm Flats Anvils available on request.

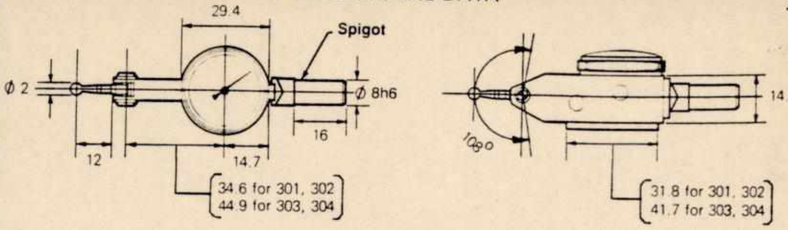
TYPE	READING	RANGE	GRADUATION	DEPTH OF THROAT
E130/0	0.1 mm	10.0 mm	0-10	20 mm
E130/3	0.01 mm	10.0 mm	0-100	20 mm
E130/1	0.001 in	0.5 in	0-100	20 mm
E142/0	0.1 mm	10.0 mm	0-10	100 mm
E142/3	0.01 mm	10.0 mm	0-100	100 mm
E142/1	0.001 in	0.5 in	0-100	100 mm
E138/0	0.1 mm	25.0 mm	0-10	50 mm
E138/3	0.01 mm	25.0 mm	0-100	50 mm
E138/1	0.001 in	1.0 in	0-100	50 mm

77

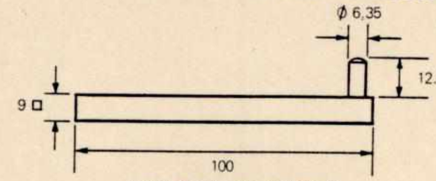
LEVER TYPE



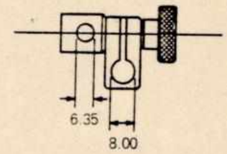
DIMENSIONAL DATA



STANDARD ACCESSORIES



HEIGHT GAUGE ADAPTOR



UNIVERSAL CLAMP

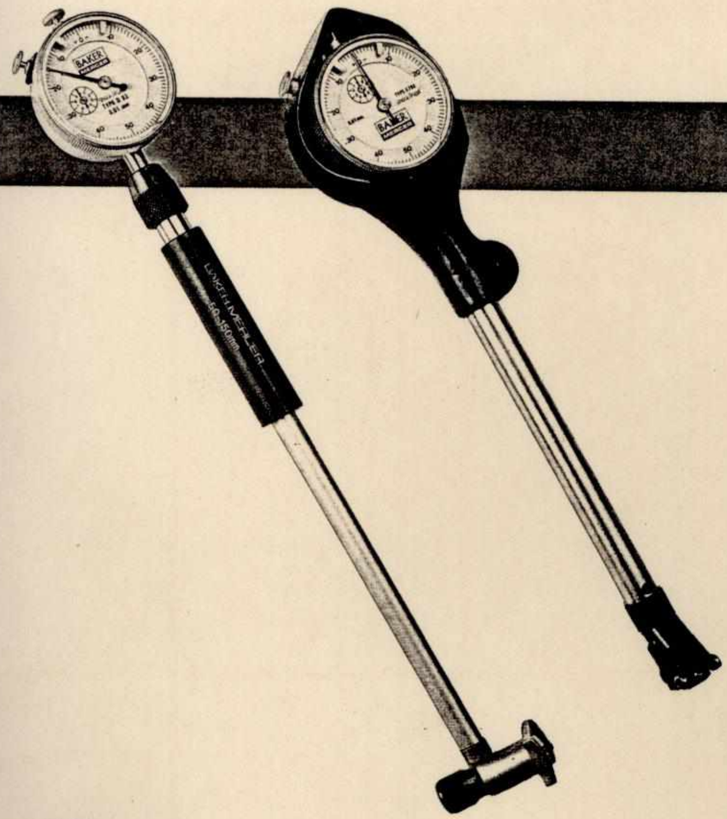
ALL DIMENSIONS IN M.M.

* Auto-Reversal   * Fitted with Jewels & Swiss Miniature Ball Bearings   * Supplied in wooden case with accessories.

TYPE	READING	RANGE	GRADUATION
302	0.01 mm	1.0 mm	0-50-0
301	0.0005 in	0.04 in	0-20-0
304	0.002 mm	0.2 mm	0-10-0
303	0.0001 in	0.008 in	0-4-0

ACCESSORIES FOR LEVER TYPE DIAL GUAGES			
Sr. No.	Description	Sr. No.	Description
1.	Stylus 1 mm Ø Chrome	4.	Height Gauge Adaptor
2.	Stylus 2 mm Ø Chrome	5.	Universal Clamp
3.	Dovetail Spigot Assembly 8 mm		

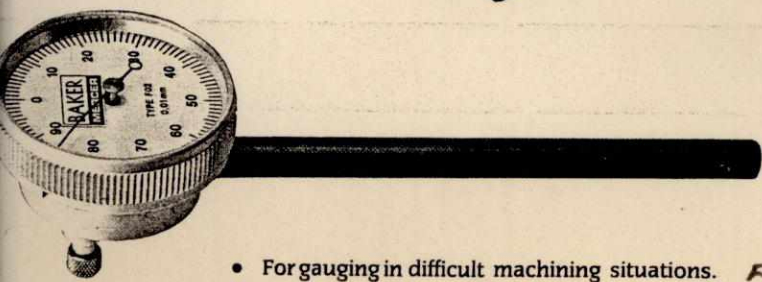
BORE GAUGES



- Self Centralizing Feature ensures measurements with minimum skill.
- All Contact faces are hardened and polished. Carbide faces available on request.
- Quick Change Collet Type Gauge Rods reduces setting time (50 - 150 mm range).
- 22-50 mm range supplied with Rotatable Shoe tips for longer life.
- Available with accessories in a sleek wooden box.

TYPE	READING	DEPTH	GRADUATION
22-50 mm Range			
702	0.01 mm	150 mm	0-50-0
717	0.002 mm	150 mm	0-10-0
701	0.0005 in	6 in	0-25-0
703	0.0001 in	6 in	0-50-0
50-150 mm Range			
D03	0.01 mm	250 mm	0-50-0
D09	0.002 mm	250 mm	0-10-0
D53	0.0005 in	10 in	0-25-0
D61	0.0001 in	10 in	0-50-0

BACK PLUNGER TYPE



TYPE	READING	RANGE	GRADUATION
F01	0.01 mm	2.0 mm	0-50-0
F02	0.01 mm	2.0 mm	0-100
F51	0.001 in	0.1 in	0-50-0
F52	0.001 in	0.1 in	0-100

- For gauging in difficult machining situations.

PROJECT NO. 3
WORK SIMPLIFICATION
IN
L.M.S.

WORK SIMPLIEICATION IN L.M.S.

Keys and spanners should be left as such if these are not interfering so that following elementary movements are eliminated.

1) Search 2) Find 3) Select 4) Transport 5) Position 6) Assemble 7) Dissassemble 8) Release Load 9) Transport empty.

For following operation with the help of superviesors, the above mentioned suggestions was accepted and implemented:

1) Spanner in case of spot milling of Can Rod 115.
2) Spanner in case of serration milling.
3) In reaming operation, spanner was made stationery.
4) Spanner in case of boring operation by end on Can Rod 115.
5) Spanner in case of key way milling of less shaft 115.
6) Following cycle (a) is reduced to cycle (b)

a) Search - Find - Select - Grasp - Transport loaded - Position - Assemble - Use - Disassemble - Preposition - Release Load - Transport empty.

b) Grasp - Use - Preposition - Rest .

Tools must be kept at a particular place and occupy fixed position w.r. to working table. Tools should be well within reach of worker. Following elementary movements are eliminated.

1) Search 2) Find 3) select .

1) Keys/spanner in case of taper Grinding Cam shaft 115

Reamers.

2)Boring/tapping tools incase of of tapping all sides.

WORK SIMPLIFICATION IN LIGHT MACHINE WORKSHOP

Subject: Improvement in productivity regarding parting off operation on power Hacksaw by using newly designed fixture accomodating two jobs simultaneously

Operation: Parting off Com Rod 115

Machine : Parting off Power Hacksaw

Make : COOPER

Standard time per job = 4.8 minutes (according to IED)

Observed timings in case of single job

Elemants	time
1. Picking of job and keeping it on bed.	5 seconds
2. Locating and fixing it on bed.	15 Seconds.
3. Assembling of clamps and tightening of unit.	10 seconds.
4. Bringing the cutting blade down from unit	5 Seconds.
5. Cutting time	160 seconds.
6. Switching off and adjusting the blade certain height.	7 seconds.
7. Loosening the unit	7 seconds.
8. Disassembling of clamping unit.	10 seconds
9. Keeping away of parted off job.	7 seconds.
Total observed time	= 219 seconds
	= 3.7 minutes.

Proposed timings in case of double loading.

1. Picking up jobs simultaneously and keeping on them bed.	= 10 seconds.
2. Locating and fixing of Ist job.	= 15 seconds.
3. Locating and fixing of IInd job.	= 15 seconds.
4. Assembly Ist clamp and nut	= 5 seconds.
5. Assembly IInd clamp and nut	= 5 seconds.

6. Tightening of Ist unit 7 seconds.

7. Tightening of 2nd unit 7 sedonds.

8. Bringing the blade down 3 seconds.

9. Cutting time 205 Seconds.

10 Switching off and adjusting blade in rest position. 7 seconds.

11 Loosening the Ist unit 7 seconds.

12 Loosening the 2nd unit 7 seconds.

13 Disassembling Ist clamp 5 seconds.

14. Disassembling 2nd clamp 5 seconds.

15 Disassembling Ist job 5 seconds.

16. Disassembling 2nd job 5 seconds.

17. Keeping away of jobs 10 seconds.

Total time for party off two jobs 323 Seconds.

= 5.6 minutes.

Gain in minutes in case of proposed method as per standard time $=(2 \times 4.8)-5.6$

$= 9.6 - 5.6 = 4.0$ minutes

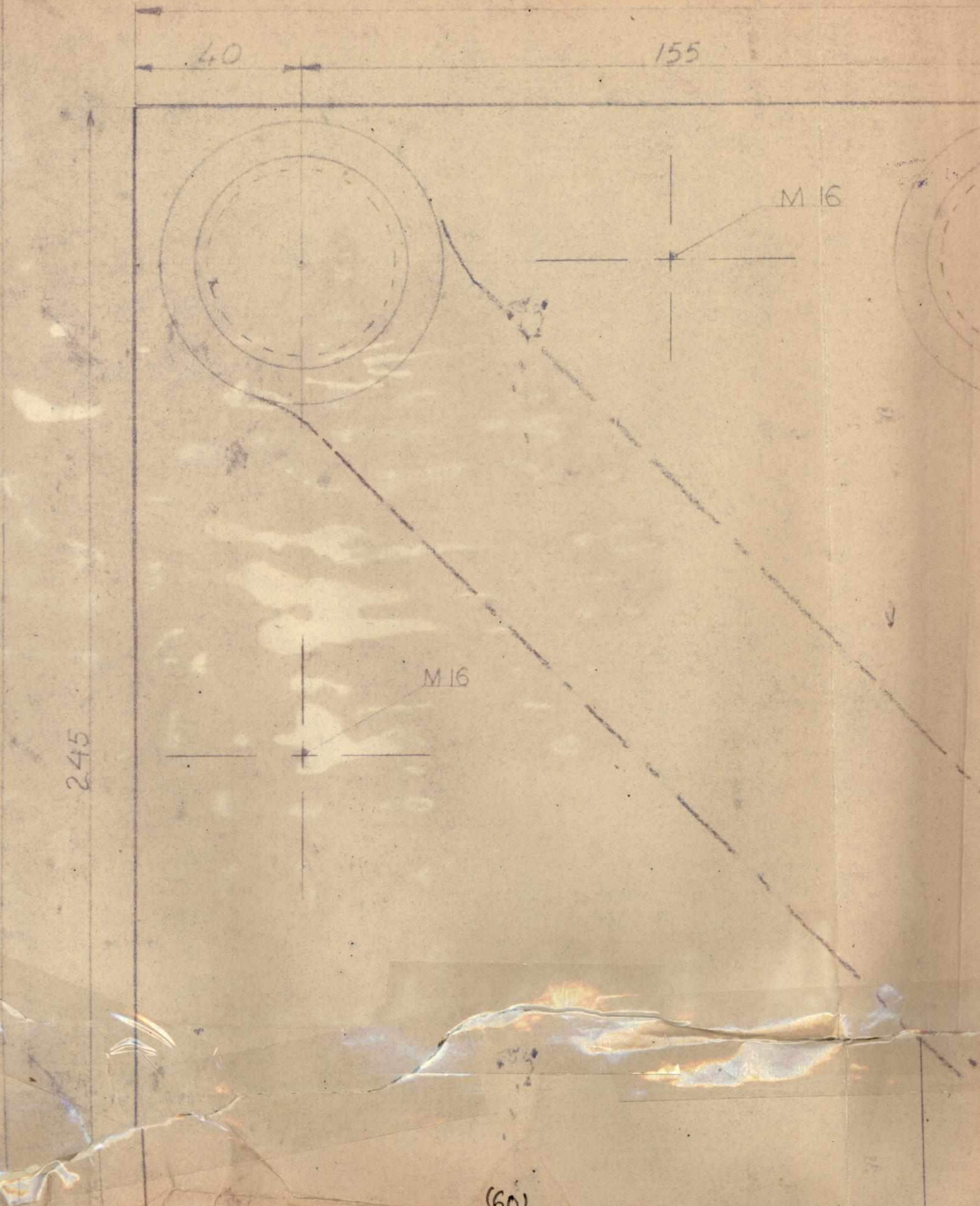
Percentage gain of present S.T. $= \frac{4.0}{9.6} \times 100 = 42\ \%$

Working at 70 P.I. we will be getting $(84 \times 2) \times \frac{70}{100} = 117$ Jobs in a shift of 8 hrs.

Presently we get just 65 jobs at 70 P.I.

Therefore increase in productivity = 117(-)65 = 52

Thus productivity is enhanced by $\frac{52}{65} \times 100 = 80\%$


40
155
M 16
M 16
245

ESTIMATION OF COST OF PROPOSED FIXTURE

Sr. No.	Component	Material	Weight of component (kg)	Cost of material (Rs)	Manufacturing cost	Total cost of component
1.	Base Plate	M.S.	24.04	205.00	240.00	445.00
2.	Locator-I	En 36	2.10	20.50	50.00	70.50
3.	Locator-II	En 36	1.71	16.70	40.00	56.70
4.	Resting Plate-I	En 36	1.68	16.25	15.00	31.25
5.	Rest Pad-I	En-36	0.16	2.00	10.00	12.00
6.	Resting Plate-II	En-36	0.40	4.50	10.00	14.50
7.	Rest Pad-II	En-36	0.36	4.00	6.00	10.00
8.	Clamp-I	M.S.	1 .47	12.60	25.00	37.60
9.	Clamp-II	M.S.	1.47	12.60	25.00	37.60
10	Heel Pin-I	En-8	0.10	2.00	10.00	12.00
11	Heel Pin-II	En-8	0.10	2.00	10.00	12.00
12	Nuts and bolt		1.00	25.00	-	25.00

Total weight of proposed fixture = 34.59 kg.

Manufacturing cost of proposed fixture = 764.15
Cost of case Hardening and grinding = 200.00
Total cost of fixture 964.15
Say Rs. 965/-

QUICK CHANGE TAPPING TOOL HOLDERS

RECOMMENDATIONS FOR WORKSIMPLIFICATION

In recent years, the metalworking industry has gone through quite a few technical advances in different aspects, one of which being increasigly turning from single-spindle to multi-spindle drilling and tapping operations for more economical production.

Tapping with multi-spindle machine however did pose a set of problems which remained to be solved before multi-spindle tapping could possibly be carried out to satisfaction.

The factors, encountered while tapping on multi-spindle, like close spindle centres, higher cutting speeds with shorter cycle times, compensation required to meet the difference between the thread pitch and spindle feed, tapping requirement at different levels, protection to taps, short time in tool changing, threading in blind holes, etc. demanded a system by which satisfactory multi tapping operation can be achieved.

IMI quick change tapping chucks in combination with various quick change tap adaptors have been developed to meet all such requirements, which have now a record of proven performace in varities of applications in various industries where multi-spindle machines, special purpose machines, transfer lines, etc. are in operation.

Our these tooling can be used on mechanical, hydraulic, pneumatic or NC and CNC machines. They can also be used on single-spindle machines for tapping.

Available in capacity from M1 to M48, IMI Quick Change Tooling which can be used in vertical, angular or horizontal position consists of :

Quick Change Tapping Chuck & Quick Change Tap Adaptor

Their distinctive features are :

Quick Change Tapping Chuck

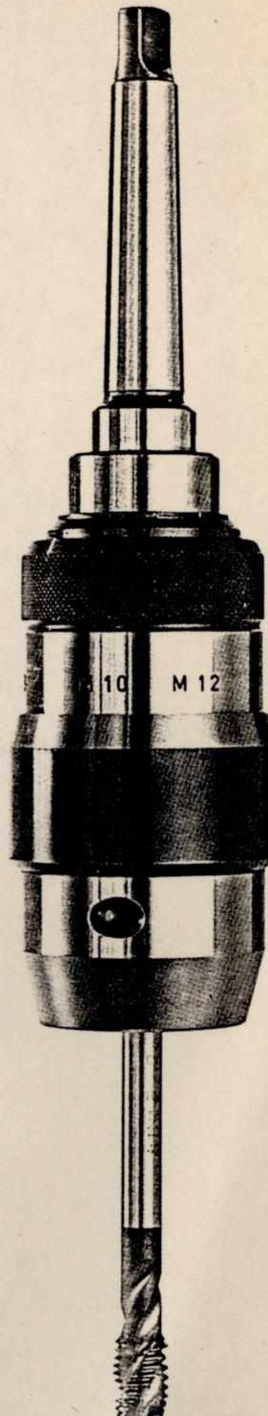
- Small outside diameter
- Quick chang of tap adaptors
  - for disengagement of adaptor the knurled sleeve of the chuck is only to be pushed back to eject it, and for engagement simply push the adaptor into the chuck
- Radial float
  - misalignment between axis of core hole and the tap is corrected by the action of this float device. The float acts in the lateral direction only, and thereby eliminates oblique cuts. Tapping of thread true to gauge is thus guaranteed.
- Ball bearing length compensation device - acting on compression expansion or on both compression & expansion
  - is of advantage when tapping with positive mechanical feed
  - compensates for pitch differences between the taps and also for machine feed and tap pitch variances, thereby eleminating thread distortion
  - eliminates damage to the machine spindle when core hole is not drilled or is shallow or in case of tool breakage because the positive feed of the machine spindle is then compensated by this length compensation device
  - acting on compression is used for tapping operation with feed control such as by lead screw or similar when the amount of feed is the same or more than than the tap pitch
  - acting on compression and expansion is used for tapping operation on machine with hydraulic or pneumatic feed control, feed control by cam action or witout feed control and where the amount of spindle feed is less than the pitch of theread to be cut
  - when exactly positioned and fitted to act on compression only or on compression and expansion, exact cutting dep ths are obtained
- Available with or without radial float and/or length compensation device

The use of these chucks requires reversible machine spindles.

Quick Change Tap Adaptor

- Quick change of tap by merely depressing the adaptor bush and inserting the tap
- Sensitive and smooth-operating ball clutch
  - this eliminates tap breakage which may occur when the tap becomes dull and thereby takes higher torque or tap bottoms in a blind hole
- Length adjustment device
  - makes finer adjustment of height possible to meet tapping requirement at different levels or due to different tap lengths
  - also helps in adjusting the setting after tap regrinding
- Available with or without safety clutch and/or length adjustment device

Adaptors for left-hand thread are available on request.



z-Quick Change
illing Chuck Type SBK
drilling, counterboring,
amfering, reaming and
ping operations on
ing, radial drilling and
machines.

ck change systems
n automatic locking of
adaptors in the chuck.
l changes can be made
n spindle stationary or
ning. Minimum move-
nt when changing tools.

h concentricity by the
ally and radially free-of-
y location of the adaptor
er.

nge: MK 1 – MK 5
M 4 – M 48

Bilz-Quick Change
Drilling Chuck
Type ASBK
for drilling, counterboring, chamfering, reaming and tapping operations on mechanically and numerically controlled boring mills.

Quick change system with the automatic locking of adjustable adaptors in combination with the Bilz-adjusting nut type SSM. One-hand tool change during standstill of machine spindle without additional tooling.

Range: Adjustable
Adaptors dia. 28 – 55 mm

Bilz-Quick Change
Drilling Chuck
Type ASBA-ASBVA
for one-hand operation. For drilling, counterboring and chamfering operations on special purpose machines, transfer lines and multi-spindle drilling machines.

Drilling Chucks type ASBA are attached to spindles conforming to German standard DIN 55058 and BS 1935:1972, or similar. In combination with the Bilz-adjustable nut SSM, adjustable adaptors and other tools with trapezoidal or ACME thread can easily be quick-changed.

Range: Adjustable
Adaptors dia. 12 – 48 mm

Bilz-Quick Change
Drilling Chuck
Type MSB
for drilling, counterboring, chamfering and reaming operations on transfer lines, special purpose machines and multi-spindle heads.

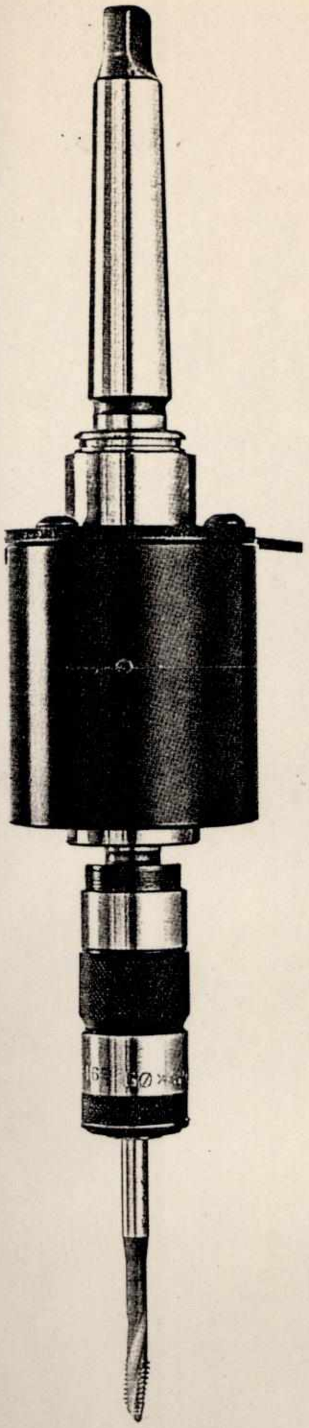
Quick change system with automatic locking of adaptors in the chuck. Outer diameter conforms to the spindle diameters specified in DIN 55058. Smallest centre distance between spindles 12 mm. Quick change drilling adaptors with length adjustment to suit tools with morse tapers or parallel shanks.

Range: MK 1 – MK 3
Diameter 1 – 9 mm

Bilz Tapping Chuck
Type DSPL-D
for tapping operations on reversible drilling and tapping machines and turning machinery.

Wide range double chucking head for the direct clamping of the taps. Adjustable safety torque clutch for the prevention of tap breakage. Radial parallel float to compensate for misalignment between hole and tap. Length compensation acting on compression and expansion to compensate differences between machine feed and tap pitch.

Range: M 3 – M 42



Bilz-Tapping Attachment Type GSA
for tapping operations on drilling and radial drilling machines, also for NC machines with non-reversible spindles.

The change in the direction of rotation is effected when the machine spindle retracts. The down feed and retraction feed are the same. The length compensation acting on compression and expansion compensates the difference in pitch of tap and feed.

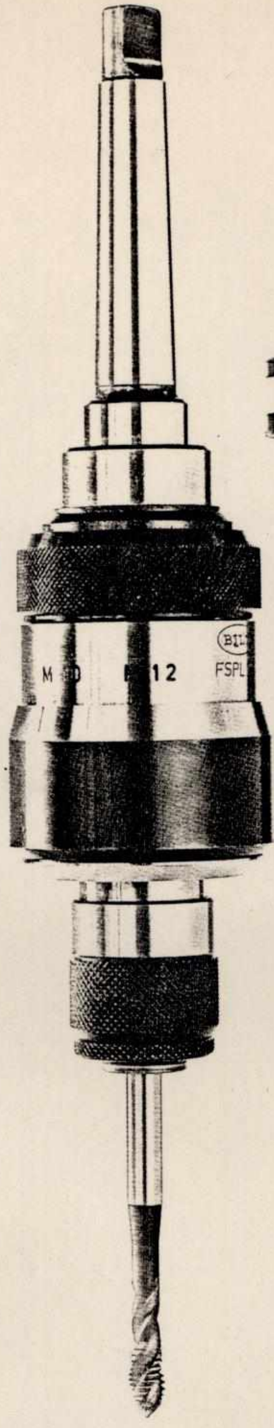
The Quick change feature suits Bilz-tapping adaptors with and without safety clutch.

Range: M 1,4 – M 20

Bilz-Quick Change Tapping Chuck Type WFSL
for tapping operations with singel pass and series taps on mechanically and numerically controlled radial drilling machines, drilling and milling machines.

Quick change system with automatic locking of the adaptor in the chuck. Adjustable length compensation acting on compression and expansion to compensate for differences between spindle feed and tap pitch. Adjustable safety clutch with minimum torque after disengagement to protect against tap breakage.

Range: M 30 – M 200



Bilz-Quick Change Tapping Chuck Type FSPL
for tapping operations on reversible drilling and tapping machines, radial drilling machines, jig mills and turning machinery.

Quick change chucking feature for the insertion of Bilz-quick change tapping adaptors. Adjustable safety torque clutch to prevent tap breakage.

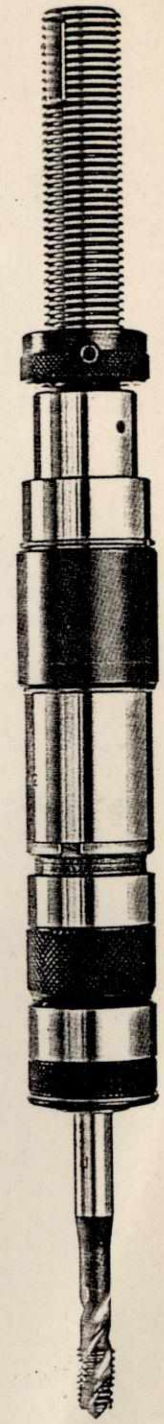
Length compensation acting on compression and expansion to compensate differences between machine feed and tap pitch. Radial parallel float to compensate misalignment between hole and tap.

Range: M 3 – M 42

Bilz-Quick Change Tapping Chuck Type WFLK
to suit taps on mechanically and numerically controlled machines, drilling machines, lathes, milling machines and machining centres.

Quick change feature to suit Bilz-Quick change tapping adaptors with and without safety clutch. Length compensation acting on compression and expansion to compensate difference between machine feed and tap pitch.
Adjustable device to increase the cutting pressure to ensure positive start of the tap.

Range: M 3 – M 68



Bilz-Quick Change Tapping Chuck Type WFLP-WF
for tapping operations on transfer lines, special purpose machines, multiple drill presses and multi-spindle heads.

Quick change feature to suit Bilz-Quick change tapping adaptors with and without safety clutch. Length compensation acting on compression and expansion to compensate difference between machine feed and tap pitch.
Radial parallel float to compensate misalignment between hole and tap.

Range: M 1 – M 48

PROJECT NO. 4

PREPARATION OF BASIS FOR BUDGET

SOME DEFINITION REGARDING INVENTORY

1) Dead stock- Which is not being used at present. It is lying in store.

2) Excess work- Which is surplus as compared to requirement for a particular period.

3) Useful stock- Which is being used at present.

4) Dead stock-value is the cost of all those tools and accessories which are lying in store and termed as dead stock.

5) Inventory is an annual exercise conducting by the manufacutring unit to know and check the store including dead stock, excess stock, useful stock etc.

FORMAT FOR CARRING INVENTORY

1) Enlisting of all the items, their rates, their marked and usage rate.

2) Codification of items. Items were divided into groups and categories. These were assigned codes. Codification will made prodess of issuing, returning etc. easy.

3) Quantity of each item was recorded from stores ledger and written against the item.

4) Randomly items were physically checked so as to see whether ledger is correct or not. About 400 items were checked.

5) Entire store stock was recorded in a proper sequence according to codes.

6) Dead stock was separated from the rest of stock. Dead stock value was calculated and reported to authorities.

7) List of useful stock and excess stock was made for raising indent.

RESULTS

After inventory dead stock value was found to be 5.25 lacs and Excess stock value was 70,000.00. On selling the dead stock a large amount of money can be recovered.

The list of useful stock helped in raising the annual indent.

DEAD STOCK ANALYSIS

S.NO.	DESCRIPTION	QTY	UNIT COST RS.	TOTAL PRICE RS.
1.	Gear Shaper Cutter for Bull Gear	06	3392.00	20,352.00
2.	Lay Shaft/PTO Shaft 241/242 Shaper Cutter	05	2442.00	12,215.00
3.	Lay Shaft 241 Shapter Cutter	05	2808.00	14,040.00
4.	Primary Shaft 241 & C.M.Gear Shaper Cutter	01	2457.00	2,457.00
5.	Quick Short Device Gear Shaper Cutter.	03	2184.00	6,552.00
6.	Hob for Spur 2nd/3rd/4th	10	4516.00	45160.00
7.	Hob for Lay Shaft 241	03	5150.00	15,445.00
8.	Bull Gear Hobs	11	NA	NA
9.	Lay Shaft 242 Hobs	12	3948.00	47,376.00
10.	Primary Shaft 241 Hobs	03	4303.00	12,909.00
11.	Integral Rear Shaft Hob	07	4098.00	28,686.00
12.	Spline Shaft Hob 241	03	5035.00	15,105.00
13.	Hyd.Shaft Hob	00	2093.00	0.00
14.	Hyd.Shaft Hob	00	2600.00	0.00
15.	Gear Hob 4mm (Special)	01	1638.00	1,638.00
16.	F.D.Gear Shaving Cutter	03	15503.00	46,509.00
17.	Engine Gear RH/LH	01	13,367.00	13,367.00
18.	Serration Broach	01	31,370.00	31,730.00

Dead Stock Value of Gear Cutting tools as on 5-5-88 =Rs 3,13,541.00

Dated:18.05.8

EICHER TRACTORS LTD (PARWANOO)

MAIN STORE INVENTORY OF CUTTING TOOLS/HAND TOOLS/ACCESSORIES, GRINDING WHEELS & SPARES

(69)

Code	Item	Description		Make	Unit Cost	Excess Qty.	Excess Cost	Dead Qty	Dead Cost
	P/Shank Drill	2.0	25/50	Add.	3.97	-	-	20	79.40
	-do-	2.5	30/65	Add.	3.62	-	-	04	14.48
	-do-	3.2	35/65	Add.	15.40	-	-	04	61.60
	-do-	4.2	45/75	Add.	5.81	-	-	00	0.00
	-do-	3.5	40/70	Add.	2.05	-	-	16	32.80
	-do-	4.5	55/80	Add.	8.67	-	-	04	34.68
	-do-	5.5	55/92	Add.	7.22	-	-	05	36.10
	-do-	6.5	60/100	Add.	9.75	-	-	07	68.25
	-do-	6.8	70/105	Add.	8.97	-	-	10	89.70
	-do-	7.5	70/110	Add.	9.11	-	-	05	45.55
	-do-	7.7	75/115	Add.	10.84	-	-	05	54.20
	-do-	9.5	81/120	Add.	15.96	-	-	04	62.40
	Centre Drill	6.3x16	-	Add.	240.05	-	-	33	7936.05
	-do-	6.3x20	-	Add.	228.66	-	-	12	2743.00
	H.S.S.T/Sh.Drill	16.8	200/315	IT.	320.00	-	-	19	6080.00
	-do-	17.5	250/400	IT.	224.55	-	-	29	6511.95
	-do-	18.5	200/365	IT.	350.00	-	-	15	5250.00
	-do-	23.5	225/400	IT.	394.68	-	-	19	7104.00
	-do-	35.0	160/335	Add.	433.07	08	3464.64	-	-
	-do-	45.0	180/365	Hadd.	364.69	-	-	01	364.69
	-do-	47.0	180/350	Add.	840.55	-	-	06	5040.30
	-do-	15/32"	145x295	Add.	338.12	-	-	06	2028.72
	-do-	19/16"	170x345	Add.	324.22	-	-	01	324.22

Conted....

Item	Description		Make	Unit Cost	Excess Qty	Excess Cost	Dead Qty	Dead Cost
H.S.S.T/Sh.Core Drill	38.0	100/345	Hada.	574.00	-	-	03	1722.00
-do-	31/32"	160/280	Add.	205.50	-	-	08	1644.00
-do-	15/32"	180/300	Add.	338.12	-	-	06	2028.72
H.S.S.T/Sh.M/C Reamer	8mm	60/140		36.64	-	-	21	269.49
-do-	10D"	70/150		67.48	40	2699.20	-	-
-do-	$25F^8$	130/250	ASH.	215.00	-	-	01	215.00
-do-	28mm	125/250	ASH.	300.00	-	-	01	300.00
-do-	30C9	140/240	Himco.	335.43	-	-	09	3018.87
-do- Jig Reamer	12mm	45/125	IT.	191.00	-	-	14	2674.00
-do-	$14H^8$	39/120	Hada.	250.00	02	500.00	-	-
-do-	$18H^8$	55/350	Gemco.	452.25	-	-	04	1809.00
-do-	$25C^9$	70/270	Handa.	252.66	-	-	02	505.32
H.S.S.Hand Reamer	10D"	70/300	Gemco.	85.82	-	-	02	171.04
-do-	12mm	75/150	IT.	68.64	-	-	02	137.28
-do-	$18E^8$	95/300	Gemco.	70.25	-	-	02	140.50
-do-	$18H^8$	95/300	Gemco.	161.81	-	-	02	323.62
-do-	$20H^8$	100/300	Gemco.	237.69	-	-	02	475.38
-do-	20mm	100/200	IT.	410.80	-	-	03	1230.00
-do-	$25H^7$	115/300	Gemco.	282.50	-	-	02	565.00
-do-	$30C^9$	125/300	IT.	300.00	-	-	09	2700.00
arbide Tip Taper/Sh. dj.Reamer	$12H^7$	-		150.00	-	-	01	150.00
-do-	26.0T7	-		199.68	-	-	01	199.68
-do-	28.95	30.16		116.60	-	-	01	116.60
-do-	38.9	46.3	JTC.	734.24	-	-	01	734.24
-do-	38	-		1044.00	-	-	03	3132.00
-do-	39	-		1044.00	-	-	03	3132.00

(70)

Contd.......

tem	Description		Make	Unit Cost	Excess Qty	Excess Cost	Dead Qty	Dead Cost
hell Reamer H.S.S.	40.5N8		Hada.	318.30	-	-	02	636.60
-do-	68.00		IT.	176.80	-	-	01	176.80
-do-	80.0		Minimax.	1080.28	-	-	01	1080.28
aper Pin Reamer	5mm		Add.	78.99	-	-	02	157.98
-do-	6			93.61	-	-	01	93.61
-do-	8			86.81	-	-	02	173.62
-do-	12			191.00	-	-	01	191.00
-do-	16			141.64	-	-	01	141.64
-do-	20			200.00	-	-	03	600.00
-do-	25		Add.	250.00	-	-	03	750.00
S.S.P/Sh.Slot Drill	3.0	6x40		39.95	-	-	08	319.60
-do-	4.0	9x40		53.27	-	-	07	372.89
-do-	8.0	10x50		90.00	-	-	29	2610.00
S.S.End Mills	4.0	11x43		44.99	03	139.97	-	-
S.S.Machine Taps	M12x1.5			79.33	25	1982.50	-	-
-do-	M24x1.5		Add.	191.08	-	-	04	764.32
-do-	M30x1.5			350.00	25	8750.00	-	-
-do-	M24x3			353.67	-	-	00	0.00
S.S.Hand Taps	M6x1.0			86.91	09	782.19	-	-
-do-	M10x1.0II			36.60	-	-	05	782.19
-do-	M10x.5 II		Add.	32.46	-	-	08	259.68
-do-	M14x1.5 I			150.44	06	902.40	-	-
-do-	M16x1.5(Set of2)			99.72	-	-	02	300.88
-do-	M16x1.5 III		Add.	[illegible]	-	-	02	199.44
-do-	M22x1.5 (Set of 2)			272.68	01	272.68	-	

(72)

de Item	Description	Make	Unit Cost	Excess Qty	Excess Cost	Dead Qty	Dead Cost
H.S.S.Hand Taps	M20x2 (Set of 2)		92.33	-	-	01	-
-do-	M22x1.5 III		335.76	-	-	02	671.52
-do-	M22x2 (Set of 2)		173.92	-	-	01	173.92
-do-	M24x2 II		79.49	-	-	02	158.88
-do-	M24x3 (Set of 3)		54.48	02	108.96	-	-
-do-	M24x3 (Set of 2)		-	01	281.53	-	-
-do-	11/16"x18	Add.	20.00	-	-	01	20.00
-do-	3/8"x24 (Set of 3)	Totem	40.88	-	-	01	40.88
-do-	9/16" (Set of 3)		245.00	-	-	05	1225.00
H.S.S.Dies	M10x1.0	Totem	52.99	02	105.98	-	-
-do-	M16x2.5	Totem	89.60	01	89.60	-	-
Int.Grinding Wgeel	40x40x13	GN	18.72	-	-	10	187.20
-do-	5/40x30/55x16		27.30	-	-	15	409.50
-do-	50x25x12.7	GN	16.38	-	-	43	204.34
-do-	50x25x15	-	16.38	-	-	02	38.76
-do-	63x45x25.4	GN	30.80	-	-	48	1478.40
H.S.S.Hand Taps	5/16" (Set of 3)	Totem	150.00	-	-	01	150.00
Mtd.Point	B-136	GNO	6.29	37	232.73	-	-
-do-	W-175	GNO	4.46	60	267.60	-	-
-do-	W-178	GNO	5.26	-	-	-	-
-do-	W-205	GNO	7.23	-	-	94	679.62
-do-	W-220	GNO	7.23	-	-	543	4197.39
-do-	Ø30MA	GN	231.38	-	-	01	231.38
-do-	Ø60		231.38	-	-	01	231.38
-do-	6"x1½"	GN	14.65	-	-	85	1245.25
-do-	36x40x6MA	GN	231.38	-	-	00	0.00
St.Cup Wheel 75x50x20	A60K5V16	CVN	52.75	-	-	02	105.50

Conted.......

(73)

Item	Description	Make	Unit Cost	Excess Qty	Excess Cost	Dead Qty	Dead Cost
St. Grinding Wheel 75x25x12	A24R5VN	GN	52.26	49	850.64	-	-
-do- 100x13x31.75	37C24L5VK	GN	20.03	150	3004.50	-	-
-do- 150x6x31.75	A1205V30	G.Uni	67.60	-	-	02	135.20
-do- 150x25x31.75		G.Uni	13.87	-	-	03	41.61
-do- 152.4x12.7x 31.75	AA60K5VG1	G.Uni	29.90	-	-	50	1749.00
-do- 200x16x50.8	A46P5V99	G.Uni	31.28	-	-	09	281.52
-do- 250x25x79.2	38A56/54KSV5E	G.Uni	32.86	25	821.50	-	-
Dish. Grinding Wheel	100x13x19.5	G.Uni	143.20	-	-	08	1144.00
-do-	-do-	GN	26.29	-	-	03	78.87
-do-	150x13x31.75	GN	129.95	40	5198.00	-	-
-do-	152.4x12.7x31.75	GN	29.91	-	-	72	2153.52
Carbide Inserts	K20CCMA 060204	W	9.94	380	3777.20	-	-
-do-	P30SNMG 120408		29.09	500	14545.00	-	-
-do-	K20SMMG 190616		64.97	-	-	80	5197.60
-do-	K20SNMA 190616		26.86	-	-	85	2283.10
-do-	P30TPAN 1603EDR		30.16	159	4795.00	-	-
-do-	K20TPAN 2204 PDR		43.02	-	-	160	6883.20
-do-	K10TPGN 160308		27.52	200	5504.00	-	-
-do-	K10TPGN 110304		20.75	100	2075.00	-	-
-do-	P30TPUN 160312		10.05	-	-	111	1115.55
-do-	K20TPUN 220412		30.68	-	-	60	1840.80
-do-	P10/P30TNMG 160408		17.23	203	3497.69	-	-
-do-	K20TCMM 110204		10.61	-	-	14	148.54
-do-	H20TPR 1104.20		15.16	-	-	12	181.92
BSP Die Set	1"	Totem	43.72	-	-	01	43.72

Contd.....

(74)

de	Item	Description	Make	Unit Cost	Excess Qty	Excess Cost	Dead Qty	Dead Cost
	D/E Open Spanner	36/45	Gedore	30.19	04	120.76	-	-
	-do-	32/36	Gedore	91.05	-	-	13	1183.65
	D/E Spanner	30/52	Gedore	14.46	17	245.82	-	-
	Box Spanner	261/68	Everest	138.78	-	-	02	277.50
	Taper Sleeve Drill	MT4/3 Old			10	-	-	-
	-do-	4/2 Old			04	-	-	-
	-do-	3/2 Old			10	702.36	-	-
	H.S.S.Tool Bit	$\frac{1}{4}$"x3"	Miranda	20.38	-	-	00	0.00
	-do-	$\frac{1}{4}$"x3"	Hada	58.53	12	-	-	-
	Quick change collect	2/4	Pittie	187.20	05	936.00	-	-
	Collect	Old MT4	-	-	-	-	01	-
	Round File	10"		19.21	12	230.52	-	-
	Square File	Smooth 10"	JK	29.28	03	87.84	-	-
	T Handle			32.25	-	-	10	322.50
	Allen Key	3/8"	Unbrako	-	-	-	10	-
	-do-	9/16"	Umbrako	14.66	-	-	02	29.32
	Pin Pinch	3mm		10.40	-	-	11	114.40
	-do-	5mm		15.60	-	-	09	114.40
	-do-	6mm		20.80	-	-	10	208.00
	-do-	8mm		22.80	-	-	10	228.00
	-do-	10mm		26.00	-	-	10	260.00
	Die Wrench	1"		20.54	06	123.24	-	-
	-do-	1.5"		44.93	12	539.16	-	-
	-do-	13/11"		17.32	03	51.96	-	-
	-do-	2"		44.93	07	314.51	-	-
	Allen Key	73.398998	Widia		-	-	30	-
	-do-	73.085.412/4mm	Unbrako	2.08	-	-	25	50.02

Conted.....7

Item	Description	Make	Unit Cost	Excess Qty	Excess Cost	Dead Qty	Dead Cost
Allen Key	174.815/4mm	Unbrako	5.30	-	-	43	227.90
-do-	174.1.864/3mm	-do-	6.29	-	-	65	408.85
Turning ToolHolder	R150-21-2525-4	Sandvik	255.63	-	-	03	766.89
-do-	R166F-2525-210 A	-do-	238.83	01	238.83	-	-
Indexable Tool Holder.	272SCP3232R	Widia	-	-	-	03	1722.24
-do-	272SCP3225	-do-	287.04	-	-	05	-
Boring Bars	RM-136-9-3216	Sandvik	378.80	-	-	01	378.90
-do-	R136Ø8	-do-	41.51	25	1037.75	-	-
-do-	R136Ø20	-do-	34.84	02	69.68	-	-
-do-	R136Ø32	-do-	151.47	-	-	-	302.94
-do-	70.17.306	Widia	139.59	-	-	03	417.00
Grooving Tool	2.65mm		71.45	87	6216.15	-	-
(St) Boring Tool	LR69.38T.157.20	Widia	112.55	-	-	05	376.75
-do-	LR69.38T.158.20	-do-	112.55	-	-	10	1125.50
-do-	LR69.38T.141.10	-do-	119.60	-	-	01	119.60
-do-	LR69.38T.143.10	-do-	132.08	-	-	01	132.88
-do-	LR69.38T.144110	-do-	137.28	-	-	02	274.56
-do-	KS69.397.3 86.20	-do-	194.63	02	389.26	-	-
Brazed Boring Tool	L142Ø10413	Sandvik	26.70	115	3070.50	-	-
Micro ~~Bore~~ Boring Tool	M243A40	PTC		02	-	-	-
-do-	M5A5RA50	PTC	367.30	40	1469.20	-	-
-do-	MTAC5A	PTC		08	-	-	-
-do-	MTA5A	PTC	257.92	-	-	23	5932.16
-do-	M10AC2P	PTC	1082.77	02	2165.54	-	-

Contd......8

Item	Description	Make	Unit Cost	Excess		Dead	
				Qty	Cost	Qty	Cost
T/Sh.Counter Bore	46mm		808.17	09	7273.53	-	-
Wood Ruff Cutter	24x4.5		127.78	-	-	13	1661.14
-do-	45.5x10		143.46	-	-	01	143.46
-do-	32x5.8		143.0	-	-	09	1287.00
-do-	13.5x4		44.82	-	-	01	44.82
Side & Face Cutter	125x25x32		827.44	-	-	01	827.44
-do-	200x20x32		1064.02	-	-	05	8320.00
Shell Mill Cutter	80x45x27		551.24	05	2756.20	-	-
-do-	50x36x22		-	-	-	02	-
-do-	80x100x32		897.30	-	-	04	3589.20
-do-	80x3x22		-	-	-	01	-
Cyl.Cutter	100x80x32		-	-	-	01	-
Concave Milling Cutter	3040	SRS	101.43	-	-	01	101.43
Slitting Cutter	150x4x32		160.19	-	-	08	1281.52
Warm Milling Cutter	10.25x29°		199.80	50	7990.00	-	-
Single Angle Cutter	50x16x12		168.44	-	-	03	496.22
BSF Cutter	20mm		130.00	-	-	05	650.00
T/Sh.M/c Male Mill	9.70mm		181.25	-	-	-	-
-do-	17.5mm		372.00	15	5580.00	-	-
Plain Plug Gauge	10mm		-	-	-	02	-
-do-	10.02		133.12	-	-	02	266.24
-do-	$10^{+0.002}$		120.64	-	-	01	120.64
-do-	$102H^{12}$		114.40	-	-	02	228.80
-do-	8H9		120.64	-	-	02	241.28
-do-	25H9		44.00	-	-	01	44.00
-do-	30H8		87.34	01	87.34	-	-

Contd.......

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Item	Description	Make	Unit Cost	Excess Qty	Excess Cost	Dead Qty	Dead Cost
Plain Plug gauge	30H9		133.12	01	133.12	-	-
-do-	$40H_{11}$		87.51	-	-	01	87.51
-do-	62H8		74.26	-	-	01	74.26
Thread Ring Gauge	M13x2		157.25	-	-	02	214.50
-do-	M20x2.5		212.26	-	-	01	212.26
-do-	M50x1.5		954.72	-	-	02	1909.44
-do-	5/8"x11		212.28	-	-	01	212.28
Snap Ring Gauge	6.3-0.5		63.65	-	-	01	63.65
-do-	14H13		-	-	-	01	-
-do-	16S6		63.65	-	-	01	63.65
-do-	17R6		63.65	-	-	01	63.65
-do-	20F8		74.26	-	-	01	74.26
-do-	25K6		74.26	-	-	01	74.26
-do-	10H8		63.65	-	-	01	63.65
D/E Snap Gauge	631.16		-	-	-	01	-
-do-	630.05		-	-	-	01	-
-do-	630.10		-	-	-	01	-
-do-	631.02		-	-	-	01	-
Taper Plain Gauge	T80:30		243.36	-	-	01	243.36
-do-	T80:50		72.47	-	-	01	72.47
Centre Setting Gauge	-		-	-	-	01	-
Rotary Bur cutters	A2		150.48	-	-	49	7373.52
-do-	T-1		168.48	-	-	08	1347.84
Clamping Arbour	-		-	-	-	01	-
Gr.Wheel Arbour	-		-	-	-	01	-
-do-	5mm		29.70	-	-	01	29.70

Conted......10.

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Item	Description	Make	Unit Cost	Excess Qty	Excess Cost	Dead Qty	Dead Cost
Measuring Pin	4.0x3		31.79	-	-	05	158.95
-do-	5.0x2		31.79	-	-	06	190.74
-do-	6.0x2		31.79	-	-	06	190.74
Cleaning Angle Setting Device	-		-	-	-	-	-
Wedge for Inserts	73.084.742		70.33	20	1406.60	-	-
-do-	73.084.734		101.97	10	1019.70	-	-
Wedge for ~~Axle~~ Axial Support	73.084.735		53.67	44	2361.46	-	-
Wedge for Insert	73.084.727		-	20	-	-	-
Wedge for Axial support	73.084.729		101.92	06	815.36	-	-
-do-	265.2.840		72.28	05	361.40	-	-
Shim	175.2.851		24.23	-	-	20	484.60
-do-	174.3.852m		53.04	-	-	20	1060.80
-do-	178.5.851		36.55	-	-	13	475.15
-do-	174.2.851		36.55	-	-	18	657.90
-do-	265.2.834		112.36	10	1123.60	-	-
-do-	73.088.320		92.47	10	274.50	-	-
-do-	10CSPM		58.40	20	1168.20	-	-
Shim Pin	174.3872		40.88	-	-	05	204.40
-do-	174.3.862		3.84	-	-	20	76.80
-do-	174.1.815		-	-	-	10	-
-do-	174.1.896		4.77	-	-	02	9.54
-do-	174.1.866		2.11	-	-	18	37.98
-do-	174.9.891		4.25	-	-	05	21.25
-do-	174.3.861		34.47	175	6032.25	-	-
-do-	174.1.842		7.14	-	-	35	249.90

Contd......

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Item	Description	Make	Unit Cost	Excess Qty	Excess Cost	Dead Qty	Dead Cost
Shim Pin	174.5.842		7.84	-	-	50	392.00
Clamp Set	175.1.824		55.12	-	-	05	275.60
-do-	174.9.831m		52.00	-	-	20	1040.00
-do-	174.9.830.1		56.62	-	-	55	314.00
-do-	174.9.838.1		65.52	-	-	10	655.20
-do-	174.9.833.2		31.24	-	-	15	468.60
-do-	174.3.864		-	-	-	10	-
-do-	173.080.447		-	46	-	-	-
-do-	73.088.998		-	25	-	-	-
-do-	73.085-865		-	05	-	-	-
-do-	CM-TC		67.93	12	815.16	-	-
-do-	174.1.869		2.28	-	-	20	45.60
-do-	174.3.841m		40.85	-	-	90	3676.50
-do-	174.3.848m		40.88	-	-	55	2248.40
-do-	174.3.842		57.72	-	-	10	577.20
-do-	73.085.601		-	40	-	-	-
-do-	438.3.841		-	02	-	-	-
Chip Breaker	DD 3102		29.44	-	-	20	588.80
-do-	73.085.812		43.16	-	-	40	1726.80
-do-	73.085.804		34.32	-	-	50	1716.00
-do-	73.085.886		16.85	-	-	40	674.00
-do-	M20/670.24		44.75	-	-	20	895.00
-do-	106-CB		46.05	10	460.50	-	-
Washer	73.080.242		-	-	-	20	-

Contd.......12

(08)

Item	Description	Make	Unit Cost	Excess Qty	Excess Cost	Dead Qty	Dead Cost
Shim Screw	SMS-10C		13.83	25	345.75	-	-
Shim	265.2.834		117.57	15	1763.10	-	-
-do-	175.2.850		44.34	-	-	14	620.76
-do-	171.31.851		58.24	-	-	20	764.80
-do-	73.080.324		51.38	07	359.66	-	-
-do-	83.080.313		-	-	-	0.00	-
-do-	73.085.802		-	-	-	0.00	-
Clamp Screw	434.9.825		9.69	10	96.90	-	-
-do-	434.9.836		6.86	-	-	5	34.00
-do-	434.9.5-830		18.68	-	-	47	877.96
-do-	436.3.832		-	-	-	05	-
-do-	438.3.832		-	-	-	73	-
-do-	73.084.708		-	-	-	33	-
-do-	73.085.340		-	-	-	20	-
-do-	73.085.898		-	26	200.46	-	-
-do-	73.085.666		-	10	96.70	-	-
-do-	73.080.285		-	05	-	-	-
-do-	73.080.210		10.19	-	-	60	611.40
-do-	73.085.626		11.14	54	601.50	-	-
-do-	73.085.962		-	28	-	-	-
-do-	174.3.821		10.21	130	1424.80	-	-
-do-	174.32.830		4.69	-	-	55	255.20
-do-	174.3.8220		14.77	-	-	60	886.20
-do-	174.3.858		12.37	120	1484.40	-	-
-do-	174.1.850		18.96	-	-	-	
-do-	174.3.836		10.40	-	-	10	104.00
-do-	269.844		-	-	-	68	-

Item	Description	Make	Unit Cost	Excess		Dead	
				Qty	Cost	Qty	Cost
Allen Key Shim Screw	265.2.818		4.05	33	133.65	-	-
Assly Punches	174.3.871		2.90	50	145.00	-	-
Spare	131.403		25.85	-	-	02	51.70
-do-	R215.0020		407.44	-	-	01	407.44
-do-	R215.1.025		224.78	-	-	01	224.78
-do-	DA-596		15.70	-	-	09	141.30
-do-	A-854		7.27	-	-	10	72.70
-do-	A-105.4		9.13	-	-	10	91.30
-do-	336.54		26.47	-	-	05	132.35
Kit of Spare	73.398.105		-	-	-	04	-
-do-	73.398.112		67.98	-	-	01	67.98
-do-	73.085.125		75.92	06	455.52	-	-
-do-	73.085.131		83.92	-	-	02	167.80
-do-	73.085.152		80.62	-	-	08	644.96
-do-	73.085.154		75.92	-	-	05	364.60
-do-	73.085.352		62.40	01	62.40	-	-
-do-	73.085.637		54.37	-	-	05	271.85
-do-	73.085.641		69.68	14	975.52	-	-

Dead Stock Value of Tooling other than Gear Cutting tools
= Rs 1,90,921.00

Excess Stock Value = Rs 68,783.00

FORMATION; INSERTS CONSUMPTION; CALCULATION OF MILLING COST PER COMPONENT.

Step I : Total number of inserts issued during a particular period isgiven by tool crip. From the number we can calculate avera consumption per month.

Step II: The number of components produced (of each type) during th particular period are noted from production circular or can be taken from daily production report,. The figure is daily produce reports is accurate.

Step III: To the figures from production circular we add 10% of the produced quantity so as to account for rejection/scrap.

Step IV : Calculation of the area of each type of component to be milled and converty it into some standard.

Step V : Total area milled during the corressponding period is calculated by multiplying area milled and number of pieces produced.

Step VI : All other types of components are standarized with itself to component havey maximum area.

Step VII: Number of standard components produced during the particular period are calculated after determination of multiplying factor.

Step VIII: Area milled per insert is calculated as follows:

$$\text{Area milled per insert} = \frac{\text{Standard component} \times \text{Area of standard}}{\text{Total no. of inserts cunsumed}}$$

Step IX : Milling cost is calculated as follows:

$$\text{Milling cost per unit area} = \frac{\text{Cost of Insert}}{\text{Area Milled per insert.}}$$

STUDY FROM
JULY 87 to APRIL-88

Sr. No.	Component	Nos. actually produced	Area/piece in mm^2	Multiplying factor	Equivalent G_2 (242)	Cost of wiper consumption per piece
1.	G_1-241	7755	1554	0.39	3024	$Rs\,1.59 \times 10^{-3} \times 1554 = Rs\,2.47$
2.	G_2-241	7595	3774	0.95	7215	$Rs\,1.59 \times 10^{-3} \times 3774 = Rs\,6.00$
3.	G_1-242	4021	1797	0.45	1809	$Rs\,1.59 \times 10^{-3} \times 1797 = Rs\,2.85$
4.	G_2-242	3751	3963	1.00	3751	$Rs\,1.59 \times 10^{-3} \times 3963 = Rs\,6.30$

Total No. of wipers consumed during July 87 to April 88 = 2203

Total No. of ~~wip~~ G_2-242 produced = 15799

Number of G_2-242 produced per wiper $= \frac{15799}{2203} = 7.17$

Area Milled per wiper $= 7.17 \times 3963 = 28420.88\ mm^2$

Cost of wiper consumption per unit Area $= \frac{\text{Av. cost of wiper}}{\text{Area per wiper}}$

$= \frac{Rs\ 45.20}{28420.88} = Rs\ 1.59 \times 10^{-3}/mm^2$

STUDY FROM
JULY-87 to APRIL-88

Sr. No.	Component	Nos. actually produced	Area/piece in mm^2	Multiplying factor	Equivalent G_2(242)	Milling Cost Per piece $= Rs\,3.25\times10^{-3} \times \frac{Area}{pc.}$
1.	G_1-241	7755	1554	0.39	3024	$Rs\,3.25\times10^{-3}\times1554 = 5.05$
2.	G_2-241	7595	3774	0.95	7215	$Rs\,3.25\times10^{-3}\times3774 = 12.26$
3.	G_1-242	4021	1797	0.45	1809	$Rs\,3.25\times10^{-3}\times1797 = 5.84$
4.	G_2-242	3751	3963	1.000	3751	$Rs\,3.25\times10^{-3}\times3963 = 12.88$

Total No. of inserts Consumed during July 87 to April 88 = 5965
Wipers Consumed —— do —— = 2203
Total No. of G_2-242 produced —— do —— = 15799
Number of G_2-242 produced per insert $= \frac{15799}{5965}$
$= 2.65$

Area milled per insert $= 2.65 \times 3963\ mm^2$
$= 10501.95\ mm^2$

Cost of milling unit Area $= \frac{\text{Av. Cost of insert}}{\text{Area milled per insert}} = \frac{Rs\ 34.10}{10501.95}$
$= Rs\ 3.25\times10^{-3}/mm^2$

FORMAT FOR CAUCULATING TOOLING COST

Step I : All operations carried on a component are enlisted.

Step II : Tools which are used or applied on components are enlisted alongwith their cost.

Step III: Consumption of tools during a particular period is taken from store or tool cribs record.

Step IV : Total no. of pieces of each component produced during the particular period is given by daily production reports.

Step V : Total number of points or areas to which a tool is applied are noticed.

Step VI : Total number of points/areas applications are divided by no. of tools of a particular kind to obtain No. of points/applications per tool.

No. of points/applications per too give its usage rate.

Step VII: Unit cost is divided by No. of points/applications per tool give cost of tooling per component of that particular tool.

TOOLING COST IN CASE OF DRILLS, TAPS, REAMERS

S.No.	Tool	Desgription	Unit Rate	Holes/Tool	Cost/Hole
1	2		3	4	5
1.	TSEL	4.0 mm	108	326	0.33
2.	"	5.0 mm	110	1244	0.09
3.	"	6.0 mm	110	142	0.79
4.	"	6.5 mm	113	2044	0.06
5.	"	6.8 mm	52	497	0.11
6.	"	8.0 mm	127	603	0.22
7.	"	8.4 mm	180	3008	0.06
8.	"	9.0 mm	245	775	0.32
9.	"	9.5 mm	135	800	0.17
10	"	9.7 mm	135	1507	0.09
11	"	10.0 mm	254	124	2.12
12	"	10.2 mm	184	3332	0.06
13	"	10.5 mm	140	884	0.16
14	"	11.0 mm	82	471	0.17
15	"	11.5 mm	85	1554	0.05
16	"	11.8 mm	191	297	0.65
17	"	12.0 mm	86	3609	0.03
18	"	12.2 mm	207	2552	0.08
19	"	12.5 mm	86	2461	0.04
20	"	13.8 mm	264	597	0.44
21	"	14.5 mm	264	2137	0.13
22	"	15.0 mm	164	2350	0.06
23	"	15.5 mm	142	1450	0.09
24	"	16.0 mm	145	1200	0.12
25	"	16.25mm	287	637	0.46
26	"	16.8 mm	220	3700	0.06
27	"	18.0 mm	172	457	0.38

1	2	3	4	5
28	TSEL 18.5 mm	629	375	1.68
29	" 23.8 mm	677	412	1.68
30	" 24.0 mm	290	1540	0.19
31	" 26.0 mm	343	400	0.85
32	" 28.2 mm	427	1900	2.25
33	" 35.0 mm	802	387	0.32
34	" 37.5 mm	961	2872	0.34
35	" 55.0 mm	500	7200	0.07

1	T/Sh Core Drill 31.0 mm	660	907	0.73
2	" 36.5 mm	1139	457	2.53
3	" 39.0 mm	1374	5750	0.24
4	" 44.0 mm	1701	4000	0.43
5	" 47.0 mm	1897	1800	1.05

1.	M/c Tap M 6 x 1	47	1603	0.03
2.	" M/8 x 1.25	50	2100	0.03
3.	" M10 x 1.5	65	1750	0.04
4.	" M10x 1	72	800	0.09
5.	" M12x 1.75	91	4100	0.02
6.	" M12 x 1.5	99	1000	0.10
7.	" M14 x 1.5	120	1250	0.10
8.	" M14 x 2	120	1800	0.07
9.	" M16 x 1.5	120	2700	0.04
10	" M16 x 2	120	275	0.46

1	2	3	4	5
11	M/c Tap M18x 1.5	191	350	0.55
12	" M18x 2.5	200	482	0.41
13	" M30x 1.5	300	750	0.40

1	T/Sh.M/c Reamer 10E8	103	1400	0.07
2	" " 10D11	103	1200	0.09
3	" 10H7	103	575	0.18
4.	" 12E8	121	800	0.15
5.	" 12H7	121	4300	0.03
6.	" 13H12	155	2400	0.06
7.	" 15H7	155	2200	0.07
8.	" 17H7	151	1000	0.15
9.	" 18E8	191	400	0.48
10	" 18H8	197	400	0.54
11	" 20H7	226	490	0.46
12	" 25H7	332	400	0.83
13	" 32H8	593	900	0.66
14	" 37.5	909	470	1.94
15	" 44.5	1530	1900	0.81

DIRECT TOOL CONSUMPTION BUDGET

.No.	Particular	Total Cost Per unit			8782A			8882B	8782A	Variance		8891B	Remarks
		8781B	8781A	8782B	YTD April.	EST. May.	EST June			Act	A%		
1.	M.M.S. Components												
a)	G1 241	17.00	23.17	20.00	18.93	19.00	19.00	44.00	49.19	5.19	12%	19	1. Over consumption of inserts and spare 2. Overall 10% hike in rates of drills and taps.
b)	G2 241	19.10	26.03	24.00	30.26	29.00	29.00					26	
c)	G1 242/243/352	19.10	26.03	24.00	24.75	26.50	26.50	44.00	53.25	9.25	21%	23	1. Over consumption of drill 6.5, 12.0 and taps M8 and M14. 2. Inserts and spares high consumption.
d)	G2 242/243/352	17.00	23.17	20.00	28.50	26.50	26.50					25	
e)	ADDC	15.90	21.67	16.00	21.62	21.00	21.00	16.00	21.62	5.62	35%	19	1. Over consumption of M18×x1.5Tap, M6x1. 2. High breakage of Milling Cutter. 3. 10% hike in prices.
2.	L.M.S. Components												
a)	Cam Shaft 115	2.30	4.07	3.00	4.67	4.50	4.50	13.00	16.52	3.52	27%	3.25	1. High breakage of serration cutters, centre drill St. Grinding Wheel 300x25x127. Core Drill Ø44
b)	Con Rod 115	7.00	12.39	10.00	11.85	11.50	11.50					10.75	

Conted.......2.

.No.	Particular	Total Cost Per Unit 8781B	8781A	8782B	8782A YTD APRIL	EST. MAY.	EST. JUNE.	8782B	8782A	Variance Act	%	8891B	Remarks
C)	Cam Shaft 298	3.00	5.31	4.00	3.26	3.25	3.25					4	1. High breakage of M12x1.5 Tap Cutter ½"x60°, Core Drill 36.5 Reamer 12.2mm.
d)	Con Rod 298	5.85	10.35	15.00	16.66	16.00	16.00	19.00	19.92	0.92	5%	15	
3.	Gear Shaft 241-Set							64.49	76.32	12.28	19%	70.00	Reverse Gear hobs broken in accidents; (3 Nos. coated hobs teeth chipped off.
a)	Spur IIIrd	4.05	4.59	4.05	4.19	4.15	4.15					4.25	
b)	Spur IVth	4.15	4.70	4.15	3.94	4.00	4.00					4.00	
c)	Spur Vth	4.25	4.82	4.25	6.06	6.00	6.00					5.75	
d)	Sld. Ist	1.60	1.81	1.60	4.02	4.00	4.00					2.50	
e)	Sld. IInd	5.60	6.34	5.60	4.28	4.25	4.25					4.25	As the time of 8781 budget, cost of hob was 4000/-and in 8782 cost in 8000/-, Shaving Cutter cost hike 15,000/-to 40,000/-broach cost 15000/- 20,000/25,000, Shapper Cost 3500/-to 8000.
f)	Sld.III/IV	6.10	6.91	6.10	6.79	6.70	6.70					6.25	
g)	Sld.V/VI	5.05	5.72	5.05	6.06	6.00	6.00					6.00	
h)	C.M.Gear	3.05	3.97	3.05	3.88	3.90	3.90					4.00	
i)	Pry.Shaft	2.45	2.78	2.45	3.73	3.75	3.75					3.25	
j)	Rev.Gear	2.70	3.06	2.70	3.47	3.50	3.50					3.00	
k)	Spline Shaft	1.50	1.70	1.50	1.59	1.60	1.60					1.75	
l)	Axle Shaft	3.65	4.14	3.65	3.62	4.00	4.00					3.75	
m)	I.R.Shaft	2.50	2.85	2.50	1.09	1.20	1.20					1.50	
n)	Bull Gear	5,62	6.37	5.62	7.71	7.00	7.00					7.00	
4.	Gear Set-242							64.70	85.75	21.05	33%	73.00	
a)	Lay Shaft	1.90	2.15	1.90	1.91	2.00	2.00					2.00	
b)	Hi/Lo Cluster	3,25	3.68	3.25	4.23	4.20	4.20					3.70	
c)	Int.Shaft	2.40	2.71	2.40	4.55	4.50	4.50					3.50	
d)	Rear Axle	1.65	1.85	1.65	1.61	1.60	1.60					1.75	
e)	F.D.Pinion	5.15	5.83	5.15	5.84	6.00	6.00					5.75	
f)	I.R.Shaft	2.50	2.83	2.50	1.72	1.90	1.90					1.75	
g)	F.D.Gear	5.20	5.89	5.20	7.02	6.50	6.50					5.50	

Contd.....

.No.	Particular	Total Cost per unit 8781B	8781A	8781B	8782A YTD. APRIL	EST. MAY.	EST. JUNE.	8782B	8782A	Variance Act	%	8891B	Remarks
)	PTB Shaft	1.30	1.47	1.30	1.98	2.00	2.00					2.00	1. Cost of tooling
.)	C.M.Gear	3.25	3.68	3.25	5.31	5.00	5.00					4.25	has increased as mentioned
j)	Rev.Gear	1.55	1.76	1.55	4.20	4.00	4.00					2.50	in case of 241.
:)	Spur Pinion Ist	3.00	3.40	3.00	4.63	4.50	4.50					3.75	2. Reverse Gear hobs (3 Nos)
.)	Sp.Pinion II	3.25	3.68	3.25	4.29	4.00	4.00					4.00	broken due to accident teeth
)	Sp.Pinion III	3.50	3.97	3.50	4.45	4.25	4.25					3.80	chipped off.
)	Sld. I/II	4.25	4.82	4.25	6.04	6.00	6.00					5.00	
)	Sld.III/IV	2.70	3.06	2.70	4.24	4.25	4.25					3.00	
)	Hi/Lo Sld.	2.90	3.29	2.90	3.86	3.85	3.85					3.00	
)	P.Shaft	2.45	2.78	2.45	3.68	3.50	3.50					3.00	
.	352 Gears							29.00	35.24	6.24	22%		
a)	Rear Axle 352	1.65	1.87	1.65	1.61	1.60	1.60					1.60	
)	F.D.Pinion 352	5.15	5.83	5.15	7.02	6.50	6.50					6.00	
:)	I.R.Shaft 352	2.50	2.83	2.50	1.97	2.00	2.00					2.00	
d)	F.D.Gear 352	5.20	5.89	5.20	7.02	6.50	6.50					6.00	
e)	Worm Shaft	4.25	4.82	4.25	4.77	4.50	4.50					4.25	

PROJECT NO. 5
COLLECTION OF DATA
REGARDING
OUT HOUSE TURNING

FORMAT FOR COLLECTING DATA

Step-I . Recording of weights of Forgings.

As balance was not available in factory premises I took the forgings to a nearby Karyana shop. Two/three pieces of each item were taken. Average weight was considered.

Step-II. Recording of weights after pre-machining/pre broach turning

I went to vendor and weighed each of assigned items.

Step-III. Recording of weight of Job after finish blank turning

Few pieces were weighed in factory premises while others were weighed at vendors works

Step-IV. Recording of weight of Finished Job.

All items were weighed in factory.

Step-V. Scrap at each stage was calculated from difference in weights.

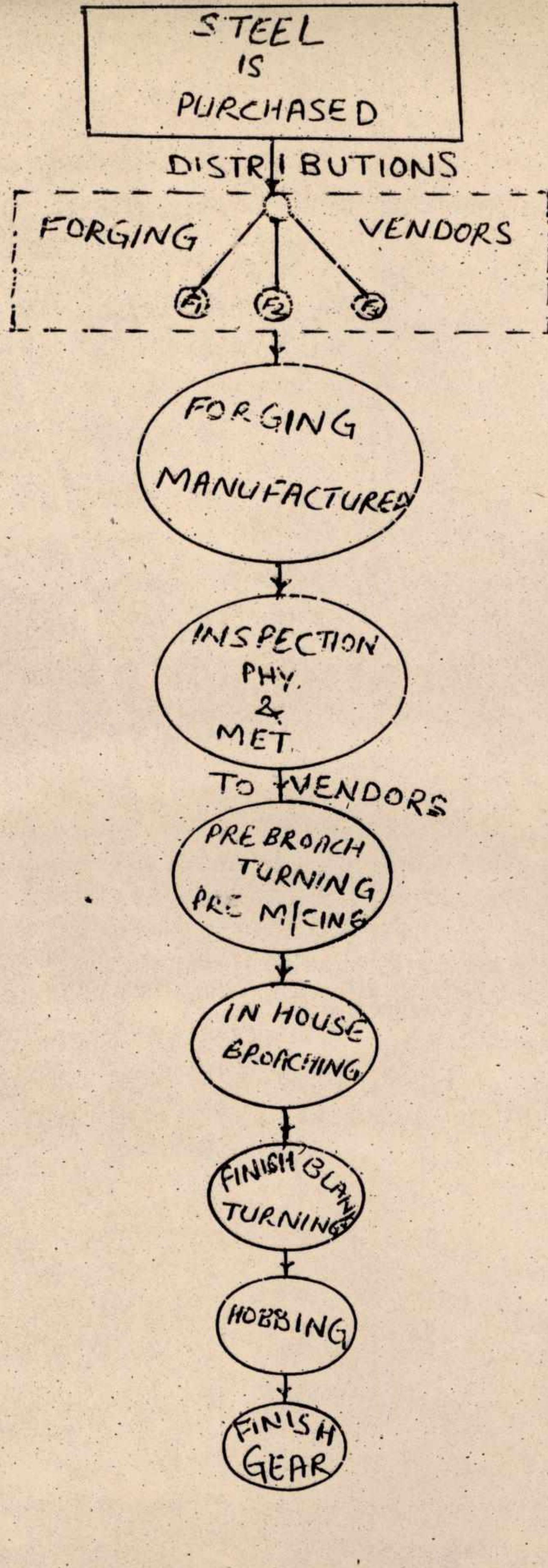
Step-VI Rates of turning were recorded. These were provided by material department.

Step-VII. Recording of times of Turning.

I visited vendor's works for this part. After careful observation, times were recorded alongwith the tool being used speed, depth of cut and r.p.m Timings for pre-broach turning and Finish blank turning were recorded in case of Gears and shafts.

Step-VIII. CALCULATION OF PROPOSED TIMES

From cutting speed and diametre of job, R.P.M. was obtained


STEEL
IS
PURCHASED
DISTRIBUTIONS
FORGING
VENDORS
F1
F2
F3
FORGING
MANUFACTURED
INSPECTION
PHY.
&
MET.
TO VENDORS
PRE BROACH
TURNING
PRE M/CING
IN HOUSE
BROACHING
FINISH BLANK
TURNING
HOBBING
FINISH
GEAR

~~bx~~ by using the relation.

$$S = \frac{\pi DN}{1000}$$

Where S - cutting speed m/minutes

D - Diameter in mm

N - r.p.m.

From r.p.m. and feed we calculated the cutting time according to the relation.

$$\text{Cutting time} = \frac{\text{Length to be turned}}{\text{r.p.m. x feed.}}$$

FOR Boring

$$\text{Cutting speed} = \frac{\text{Length to be bored}}{\text{r.p.m. x feed}}$$

Step-IX STANDARD TIMES WERE WORKED OUT

After ~~gxkkx~~ giving allowances the standard times were calculated.

WEIGHTS IN KILOGRAMES

S.No.	ITEMS	FORING WEIGHT	PRE WEIGHT	FINISH/BLANK TURNED WEIGHT	FINISHED WEIGHT	SCRAP
1	F.D.Gear-242	19.70	17.50	16.50	13.80	5.90
2	Hil[illegible] cluster-242	7.70	-	4.20	3.10	4.60
3	Sliding Gr.314-241	3.40	2.60	2.45	1.80	1.60
4.	Spur Gr.4th -241	1.60	1.25	1.10	0.90	0.70
5	SHAFTS					
1	Axle shaft	9.75	-	7.07	6.52	3.23
2	Primary shaft-241	4.75	-	3.75	3.20	1.55
3	Primary shaft- 242	5.75	-	4.40	3.30	2.45

ACTUAL TIMES AND TURNING RATES
Actual times in Minutes

Sr.No.	Item	PRE Machining	FINISH BLANK TURNING	TURNING, PRE-MACHINING	RATES IN RUPEES Finish Blank Turning
1	F.D.Gear-242	29.00	20.80	11.00	19.80
2	Hi/Lo cluster-242	-	25.60	-	28.60
3.	Sliding gear 3/4-241	10.80	8.00	3.80	8.15
4.	Spur 4th-241	7.00	5.00	2.90	5.25
	SHAFTS				
1.	Axle shaft OD	-	15.20	-	26.00
2.	Primary shaft-241	-	12.30	-	24.00
3.	Primary shaft-242	-	11.50	-	24.00

* Actual times are as per vendors performance recorded by me.

Operation covered are turning, boring, drilling, facing, chamfering.

Tools used H.S.S. and carbide.

(96)

SAMPLE STUDY IN CASE OF
F.D.Gear-242

Sr. No.	Operation	Time in Minutes.
1.	Facing, boring, turning, chamfering	12.47
2.	Facing, chamfering turning	6.20
3.	Drilling	11.00

Total time cousumed during pre machining = 29.67 minutes

Break up as follows

1) Facing, boring, turning, loading and unloading. = 4.00 minutes.

Machining time = 8.00 "

Tools used H.S.S. and c arbide

i) Loading	- 2.5 minutes.	
ii) Facing	- 2.5 "	(2 cuts)
iii) Turning	- 2.5 "	(2 cuts)
iv) Boring	- 3.0 "	(2 cuts)
v) Unloading	- 1.0 "	
vi) Chamfering	- 1.5 "	

2) Facing, chamfering, turning, loading and unloading time = 3 minutes

Machine time = 3 minutes

R.P.M. = 150

i) Laading	- 1.5 minutes.	
ii) Facing	- 2.0 minutes	(Single cut)
iii) Turning	- 1.00 "	(Single cut)
iv) Chamfering	- 0.5 "	
v) Unloading	- 0.5 "	

3) DRILLING

Loading and unloading = 3 minutes.

Drilling(including changing of tool)

Time = 7.00 minutes.

FIN ISH BLANK TURNING AFTER BROACHING

i) Loading	-2.0	minutes	(
ii) Turning	-4.00	minutes	(2 cuts)
iii) Facing	-4.00	minutes	(2 cuts)
iv) Boring	-8.00	minutes	(2 cuts)
v) Unloading	-2.00	minutes	

Total time	=20 minutes.
Tool used	H.S.S. and carbide
R.P.M.	385