DESIGN AND FABRICATION OF AUTOMATIC SPRING SCRAGGING MACHINE FOR WILSON INDUSTRIES

A PROJECT REPORT
SUBMITTED IN PARTIAL FULFILMENT OF
THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF

BACHELOR OF ENGINEERING
IN
MECHANICAL ENGINEERING

BY

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1990 - 91

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CERTIFICATE

This is to certify that the report entitled

"DESIGN AND FABRICATION OF AUTOMATIC SPRING SCRAGGING MACHINE"

has been submitted by

Mr. ....

in partial fulfilment of the award of

Bachelor of Engineering in Mechanical Engineering Branch

of the Bharathiar University, Coimbatore-641 046

during the academic year 1990-91

Guide

Head of the Department

Certified that the candidate was Examined by us in the Project Work Viva Voce Examination held on .... and the University Register Number was ....

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CERTIFICATE

This is to certify that the following students of final B.E.Mechanical Engg.,

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belonging to KUMARAGURU COLLEGE OF TECHNOLOGY, Coimbatore, have done the project work "DESIGN AND FABRICATION OF AUTOMATIC SPRING SCRAGGING" machine, under the sponsorship of our firm. They have completed the project and it is under trial production.

GENERAL MANAGER.

MANUFACTURERS OF ALL KINDS OF
HIGH QUALITY PRECISION COIL SPRINGS
FLAT SPRINGS AND WIRE FORMINGS

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ACKNOWLEDGEMENT

We are thankful to Mr. SADAGOPAN, General Manager M/S WILSON INDUSTRIES, for permitting us to utilise the resources of the industry for our project.

We wish to express our profound thanks to Mr. P. RANGARAJ, Works & Development Manager, WILSON INDUSTRIES, for his constant guidance and encouragement for the completion of the project.

Our equally intense gratitude are to Mr.K.K.MURTHY, Engineer, Development Division and Mr.K. GOPALAKRISHNAN for their valuable suggestions.

We are greatful to our Principal Prof.R.PALANIVELU, M.Sc.(Engg) ,M.I.E, M.I.S.T.E for his encouragement.

We would like to thank,Dr.ALI UDDIN ANSARI, Head of the Department, Mechanical Engineering, for the great interest shown by him in our project.

Our gratitude and obligation are due to our guide Mr.S.MEYYAPPAN, B.E., for the guidance and suggestions put forth by him. Our thanks to Mr. G.S.KUMARA SAMY, B.E., for helping us in the designing of the machine.

Finally we would like to thank the staff members of the Mechanical Engineering Department and all our friends for the suggestions given by them.

INDEX

SYNOPSIS

The scragging machine is a special purpose machine used for the presetting of springs used in shock absorbers.

The machine comprises of a pressing unit and an indexing unit. The pressing unit consists of an eccentric drive used for the compression of light springs and pneumatic drive for the compression of heavy shock absorber springs. The drive for the pressing unit is obtained through a sprocket chain from electric motor through worm gear reduction unit and through a flywheel. The indexing device positions the spring under the pressing unit for scragging.

The machine fabricated at M/S WILSON INDUSTRIES, overlaps the setting time and pressing time and thus obtains an increase in the rate of production by a factor of at least nine as compared to the conventional method.

CHAPTER I

INTRODUCTION

1.1 The ever growing demand for automobiles carries with it an equivalent demand for shock absorbers. To equip the industry to meet this demand the automation of spring manufacture for shock absorbers is necessary.

WILSON INDUSTRIES is a leading manufacturers of springs for various applications. Springs are manufactured by coiling the wire to required dimensions and the ends ground after which it is stress relieved. As springs are manufactured and initially compressed. They have a tendency to set, that is, a reduction in free length, in its free state. To prevent the setting of spring further, scragging operation is performed. Springs after scragging will not have further permanent set during operation when compressed very near to solid height.

SCRAGGING is the process of compressing the springs to solid height after which they assume a particular free length when the pressure is released. After this, the free length should conform to the specification of the customer.

Previously the springs where scragged with the help of ARBOR PRESS manually. It necessitated the use of two workers. One to hold spring in position after inserting it on a mandrel while the other operates the lever to press the spring.

The machine developed by us consists of two units:

1. PRESSING UNIT
2. INDEXING UNIT.

The machine scraggs 36 springs/minute as compared to 4 in the Arbor Press. Since the process is "Automation", the process requires only half the number of workers as compared to the manual operation.

1.2 PREVIOUS METHOD OF SCRAGGING:

Prior to the development of scragging machine the springs were scragged using an Arbor Press. The Arbor Press is shown in figure 1.1. It involved a lot of labour, which required 2 operators. One to hold the spring in position after inserting it on a mandrel and then remove the scragged spring and slide a fresh piece for the operation, and another to operate lever which has a pinion. This pinion meshes with a rack and gives upward and downward movement to the rack. The compression of the spring takes place during the downward movement of the rack.

After compressing the springs thrice, the lever of the arbor is released and the next spring is placed in position and the procedure repeated. This consumed a lot of time and labour. Also, the rate of production is low due to the increase in time consumed for setting and pressing.

ARBOR PRESS

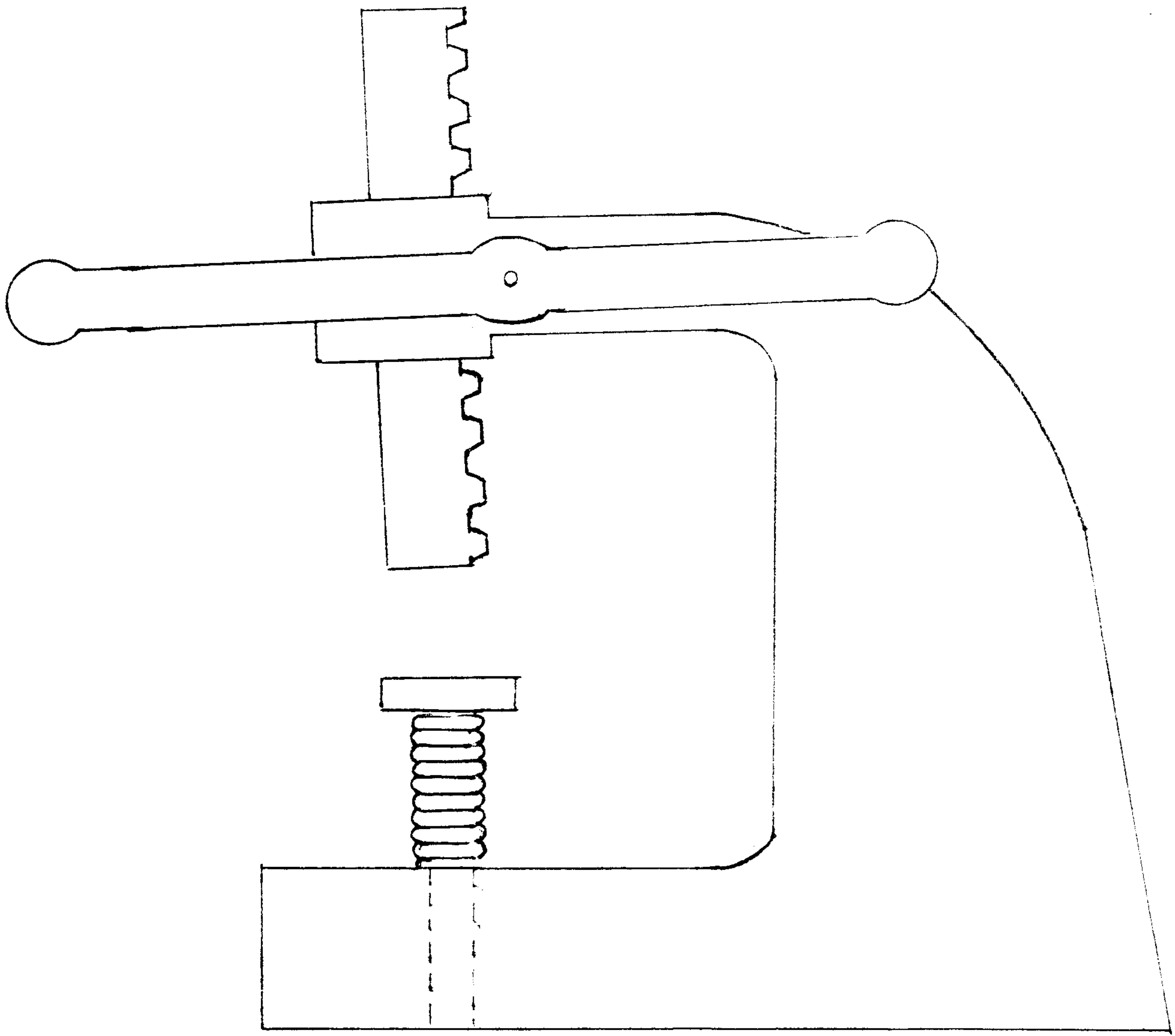


FIG 1.1

1.3 METHOD PROPOSED:

The reciprocating motion needed for the compression of springs can be obtained by using the following option which boost up the rate of production.

1. Mechanical drive using eccentric motion
2. Hydraulic Drive
3. Pneumatic drive.

A survey of existing shock absorber springs for 2 wheels reveals that a maximum of 250 Kg is needed for scragging. Hence a mechanical drive was decided to be adopted to exert pressure as required in this instance. Power can be obtained from a motor which is coupled to reduction drive, the O/P shaft of which is connected to the main shaft through 'V' belts spindle is connected to a disc which has provision for imparting eccentric motion of required stroke. This converts rotary motion into reciprocating motion. A pressing contrivance is connected to the adjustable slider on the disc and the scragging obtained.

The labour involved is decreased with the resultant increases in production. By having a device which rotates automatically to have the next spring scragged after one spring is scragged. The motion required here is an intermittent motion, so the Geneva Mechanism can be used.

The magazine plate which holds the spring should not rotate during scragging operation. To lock the plate in position, a locking arrangement can be provided. This locking of the plate can be obtained by using a DRUM CAM. The motion of the cam follower can lock and unlock the Geneva Plate which holds the indexing plate in position. The rotation of plate and locking of the pin is relative.

CHAPTER II

DESCRIPTION OF COMPONENTS

The assembly comprises of two units.

1. Pressing Unit
2. Indexing Unit.

2.1 Pressing Unit:

Pressing unit comprises of the following main components.

1. Power Unit for Pressing.
2. Eccentric drive assembly.
3. Driving screw rod assembly.
4. Slider.
5. Frame.

2.2 Indexing Unit

Indexing unit comprises of the following main components.

1. Drive for indexing
2. Geneva Mechanism
3. Cam Mechanism
4. Locking Mechanism
5. Magazine Plate.

2.1.1 POWER UNIT FOR PRESSING:

The purpose of the power unit is to supply power for the pressing operation.

The power for the pressing unit is obtained by installing a 2 H.P motor. The power from the 2 H.P motor is transmitted to the reduction gear box through a flexible coupling. It drives the eccentric through a gear box, which gives reciprocating movement. Through V - Belts, drive is transmitted from the gear box to the shaft. The gear box has a speed ratio of 40 : 1.

2.1.2 ECCENTRIC DRIVE ASSEMBLY

It is used to convert the rotary motion of the shaft to reciprocating motion of the slider.

The driving pin is mounted on the plate, the position of which is adjustable. The slide moves in a dovetail which has a screw rod. The driving pin has internal threads which mesh with the pin screw rod. When the screw rod is rotated, the driving pin moves and adjusting position of driving pin on the plate. The length of the stroke can be varied according to the requirement. The plate is balanced by providing equal weights diametrically opposite to the driving pin, which balance the weight of the slider and pressing unit. This is to provide uniform motion.

2.1.3 DRIVING SCREW ROD ASSEMBLY:

It is used to vary the length of the screw rod according to the free length of the springs.

The driving pin is attached to the screw rod. The plunger screw rod is attached to a slider. One screw rod has right hand threads and the other - left hand threads. These are screwed in a heavy tubular member with internal threads. The total length of the driving screw can be changed according to the free length of the spring and stroke desired.

2.1.4 SLIDER:

It guides the scragging plate which imparts a linear motion. The slider is connected with the driving screw rod. An 'L' bracket is provided at the bottom of the slider. These are provided to prevent collapsing of 'L' bracket under pressure. The pressing unit of the 'L' bracket has a hole for providing a bush which freely slides over a mandrel. The bush prevents the wear of the hole during scragging and it can be replaced whenever necessary.

2.1.5 FRAME:

The frame has dovetail groove fixed on the front side. The slider with the scragging plate slides in the dovetail groove. A gib is provided in the one side of th dovetail groove, to compensate for wear. Socket screws are provided on the front and sides also. By loosening the front screw, the plate on one side of the groove can move. Then by tightening the side screws which are similar to nut and bolt arrangement, the plate advances towards the slider. At the top of the frame two plummer blocks are provided to support the shaft which transmitts power to the eccentric disc.

2.2.1 POWER UNIT FOR INDEXING:

The power unit is necessary for the working of the machine. A 2 H.P motor is selected for this purpose.

Power for the indexing is taken from the main drive using a sprocket chain for positive drive. Since in this instant the power has to be transmitted at right angles to the cam shaft. Bevel gears are provided for this purpose.

2.2.2 GENEVA MECHANISM:

The purpose of providing the Geneva Mechanism is to convert the continuous motion into intermittent motion. After scragging of each spring ,the next spring has to come to the scragging zone; this function is carried out by the Geneva mechanism.

It consists of a slotted plate and a actuating finger. The plate has 18 slots. The actuating finger rotates continuously along with the cam shaft. it engages in the slot and rotates the magazine plate along with it. After rotating through 20 degrees the actuating finger disengages from the slot. The continuous motion of the actuating finger is converted into INTERMITTENT MOTION. A locking arrangement is provided diametrically opposite. The locking arrangement is to hold indexing plate in position during scragging.

2.2.3 CAM MECHANISM:

The purpose of the cam is to engage and disengage the locking mechanism.

The cam used is a drum cam which is mounted on the cam shaft. The follower lever is held in position with a tension spring when the cam rotates the follower rises against the spring force. After angle of rotation the cam has dwell period within which the indexing takes place. Then the follower comes down, and there is another dwell period during which scragging takes place.

The rising and lowering of the follower locks and unlocks the magazine plate. Thus the cam is exclusively used for the locking arrangement.

2.2.4 LOCKING MECHANISM:

The locking mechanism is provided to hold the magazine plate in position during scragging and to release it during the indexing through 20 Degrees.

The cam follower lever is attached to this mechanism. The cam follower lever which is attached to the locking finger, is held in position by the spring force. The spring pressure is used to exert an upward pressure to a lever at the end where the register pin is fixed. The locking mechanism ensures the stationary position of the magazine during the pressing operation.

2.2.5 MAGAZINE PLATE:

The magazine plate is used to mount the spring on it. For continuous operation the mounting of springs on the face of magazine in a series speeds up production by pressing the springs one after another in quick succession. The operation of loading and unloading the springs does not in anyway interfere with the scragging process.

The indexing plate is attached to the main shaft. Below the magazine plate there is a housing which consists of two sets of ball bearings. This provides smooth transmission of power. The magazine plate has 18 mandrels on which the spring slides. The mandrels can be changed depending upon the size of the springs to be scragged.

CHAPTER III

METHOD OF OPERATION

The motor is switched on, power is transmitted to the reduction gear box through the flexible coupling. The speed reduction of 40 : 1 is obtained from the gear box. The output shaft of the gear box is connected to themainshaft pulley through "V" belts. This causes the shaft of the eccentric disc to rotate. The rotary motion is thus converted into reciprocating motion at the operating end.

The drive for the indexing plate is taken from the main shaft through a sprocket chain. It is employed so that the movement of the elbow bares a definite relation to the rotation of the magazine plate. The Geneva Mechanism converts cotinuous rotary motion into intermittent motion, The cam is designed such that, it causes a locking pin to disengage from the indexing plate before the actuating finger starts rotating the disc to impart 20^{o} motion to the indexing plate which is directly coupled to the magazine plate.

After one spring is scragged the next spring comes to the scragging zone and thus the cycle of operation is repeated. The chain drive provided to the indexing plate, synchronises the motion of pressing and indexing unit.

Thus the scragging of springs to solid height is obtained by the movement of the scragging elbow in a continuous cycle.

CHAPTER IV

DESIGN OF THE COMPONENTS

4.1 Main Spindle :

$$\text{Power (P)} = \frac{2 \pi N T}{4500}$$

where Speed(N) = 36 rpm

Power(P) = 2 H.P

$$2 = \frac{2 \times \pi \times 36 \times T}{4500}$$

Therefore, Torque(T) = 39.8 Kgf.m

= 39.8×10^3 Kgf.mm

Since the shaft is subject to twisting moment only. The diameter of the shaft is calculated using the HORIZEN EQUATION.

$$\frac{T}{J} = \frac{fs}{r}$$

where T = Twisting moment acting on the shaft

J = Polar moment of inertia

fs = Tortional shear stress

r = distance from neutral axis to the outermost fibre.

= d/2, d - diameter of the shaft.

$$J = (\pi / 32) \times d^4$$

$$\frac{T}{\pi/32 \times d^4} = \frac{fs}{d/2} \quad \text{or} \quad T = \pi/16 \times fs \times d^3$$

Taking shear stress for material En8(C45) from Design Data Book and according to maximum stress theory

Safe Stress = Max. Shear Stress x (1/2)

= 36 / 2

= 18 Kg/mm^2

Assuming factor of safety fs = 2

Maximum Shear Stress = 9 Kg/mm^2

$$T = (\pi / 16) \times fs \times d^3$$

$$39.8 \times 1000 = (\pi / 16) \times 9 \times d^3$$

$$d = 28.8 \text{ mm}$$

Therefore, the diameter of the shaft is taken as 30 mm .(i.e., d = 30 mm).

4.2 SELECTION OF BEARINGS:

Equivalent Load $P = (X \times Fr + Y \times Fa) \times S$

where Fr = Radial Load = 268.8 Kgf.

Fa = Axial Load = 250 Kgf.

$$\therefore \frac{Fa}{Fr} = \frac{250}{268.8} = 0.93$$

Assuming Fa/Co = 0.13

The value of e = 0.31

$$\therefore \frac{Fa}{Fr} > e$$

$\therefore$ X = 0.56 and Y = 1.4

Taking service factor S = 1.7

$P = (0.56 \times 268.8 + 1.4 \times 250) \times 1.7$

$P = 851.8$ Kgf.

From the graph, for 36 rpm and bearing life of 15,000 hours, $C/P = 3.11$

Hence $C = 3.11 \times 831.8$
$C = 2646.24$ Kgf.

From the Design Data Book the next higher value of

$C = 2750$ Kgf.

The bearing selected is SKF 6210.

4.3 GENEVA MECHANISM

Semi Indexing Angle (Driven) = 20 deg.

Semi Indexing angle (Driver) = 90 - 20 = 70 deg.

Assuming centre distance (e) between Geneva Wheel and the centre of driving assembly is 160 mm.

For entry without shock $\sin\alpha = r/e$

where r = radius of the driving crank

e = centre distance

$r = \sin(20) \times 160 = 55$ mm.

Radius of driver pin (rp) = 10 mm (Assumed)

Radius ratio, $R/r = \cot\alpha$

$R = r\cot\alpha = 55 \times \cot(20) = 151.1$ mm

Corrected outside radius of Geneva Wheel

$R' = R \times \sqrt{1 + (rp^2 + R^2)}$; $R' = 160$ mm

$S = e \times (1 - \sin\alpha)$

$S = 55 \times (1 - \sin(20)) = 106$ mm

Instantaneous power required on the driving shaft

$P = (Mt \times w) / 75$ H.P

where Mt = Net torque on the driving shaft

w = Angular velocity of driving crank

$w = 2 \times \pi \times N / 60 = 2 \times \pi \times 36 / 60 = 3.8$ radian/sec

Therefore, $P = 39.8 \times 3.8 / 75 = 2$ H.P

Material for the roller :

Steel 105 Cr1 hardened to HRC 59 to 63

Material for the slotted disc :

Steel 40 Cr1 hardened and tempered to HRC 45 to 50

4.4 Indexing Plate Diameter Calculation:

Maximum diameter of the spring	= 40 mm
Distance between the two springs when mounted on the plate	= 25 mm
No. of Springs to be mounted	= 18
Circumference (C)	= 1145 mm
Allowance at the two ends	= 100 mm
Total Circumference	= 1145 + 100
	= 1245
Diameter of the indexing Plate	= 396 mm

4.5 Design of Bevel Gears

The torque to be transmitted is 3978.8 kgf.cm the required gear is one.

Twisting moment Mt = 1978.8 Kgf/cm

Design twisting moment (Mt) = Mt x K.Kd

The value of K.Kd is assumed as 1.3

So, (Mt) = 3978.8 x 1.3

= 5172.5 Kgf.cm

Calculation of Cone distance

$$R = \psi_y \sqrt[3]{i^2 + 1} \sqrt[3]{(0.72/(\psi_y - 0.5)(\sigma_c))^2 \times E(M_t)/i}$$

σ_c = Design surface stress

$(\sigma_c) = C_B H_B K_{cl}$ Kgf/cm^2

C_B = Co-efficient of surface hardness = 350

H_B = Brinell hardness number = 25

K_{cl} = Life factor for surface strength = 1

So, (σ_c) = 8750 Kgf/cm^2

Assume ψ_y = 3

Young's modulus E = 2.15 x 10^6 Kgf/cm^2

$$R = 3 \sqrt[3]{i+1} \sqrt[3]{(0.72/(3-0.5)\times 8750))^2 \; 2.15\times 10^6 \times 5172.5}$$

R = 9.72 cm

Module (m_{ave})

$$m_{ave} = 1.28 \sqrt[3]{(M_t)/(Y_v \times (_b) \; m \; Z_1}$$

Assume $Z_1 = 20$ and $_m = 10$

Form Factor $Y_v = 0.389$

σ_b = Design bending Stress

$(\sigma_b) = 1.4 \times K_{bl} / n \times K \times -1$

K_{bl} = life factor for bending taken from design data

$= 1$

K = Fillet stress concentration factor = 1.6

n = Factor of safety = 2

$-1 = 0.25 \; (u + v)_2 + 500$

$= 2975$ Kgf/cm

CHECKING THE DESIGN:

$$R = 0.5 \times m \; t \; Z_1 \sqrt{i^2 + 1}$$

$$R = 84 \text{ mm}$$

$$R = 84 < 97.12$$

Checking K.Kd :

$$d_{1av} = m \; t \; Z_1 \; (R - 0.5 \times b)/R$$

$$= 6 \times 20 \; (97.12 - 0.5 \times 29.19)/97.12$$

$$= 101.98$$

$$b/d_{1av} = 27.16 \; / \; 101.98 = 0.285$$

The load concentration factor K is selected from design data book for the corresponding value of b/d_{1av}

i.e., K = 1.1

The Dynamic load factor Kd is selected for the corresponding values of Hardness = 350 and pitch line velocity of 3 m /sec. i.e., Kd = 1.1

So, K.Kd = 1.1 x 1.1 = 1.2 $<$ 1.3

Checking σc

$$\sigma c = 0.72/(R-0.5b) \sqrt{\sqrt{(i^2 + 1)^3}/ib \quad E\,(M_t)}$$

$$\sigma c = 0.72/9.712-0.5x2.916 \quad (1 + 1)/2.916\ E\,(M_t)$$

$$= 6657.3\ Kgf/cm^2$$

$\sigma c < (\sigma c)$

$$\sigma b = \frac{R\ x \sqrt{(i^2 + 1)}\ (M_t)}{(R - 0.5\ b)^2\ b\ x\ m\ x\ Y_v\ \ Cos(\alpha)}$$

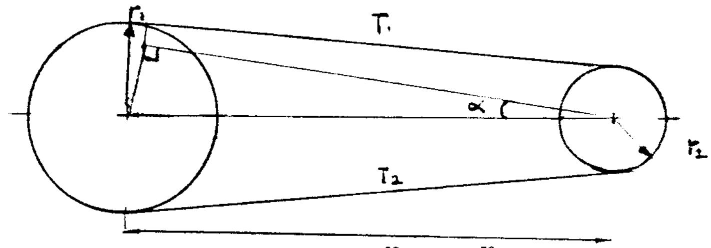
On substitution,

σb = 1612.3.

Therefore, $\sigma b < (\sigma b)$

Hence the design is safe.

4.5 DESIGN OF SPINDLE FOR PRESSING UNIT:



$$\sin(\alpha) = \frac{r_1 - r_2}{C} = \frac{178 - 89}{750}$$

$$\therefore \quad = 6^{o}\ 48' = 7^{o} \quad \text{(Approximately)}$$

$$\theta = \pi - 2\alpha = 166^{o}\ 22' = 2.9 \text{ radians}$$

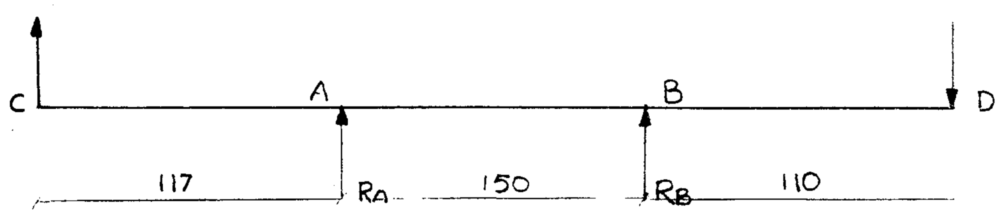
$$\frac{T_1}{T_2} = e^{0.3 \times 2.9} = 2.389$$

Velocity $V = \pi \times D \times N / 60$

$= \pi \times 0.356 \times 36/60 = 0.67$ m/sec

$(T_1 - T_2) \times 0.67 / 75 = P = 2$ H.P

$\therefore \quad T_1 = 161.18$ Kgf and $T_2 = 385.06$ Kgf



Taking moment about A

$$546.24 \times 260 + 250 \times 117 = R_B \times 150$$

$$R_B = 1141.8 \text{ Kgf}$$

Taking moment about B,

$$546.24 \times 110 + R_A \times 150 + 250 \times 267 = 0$$

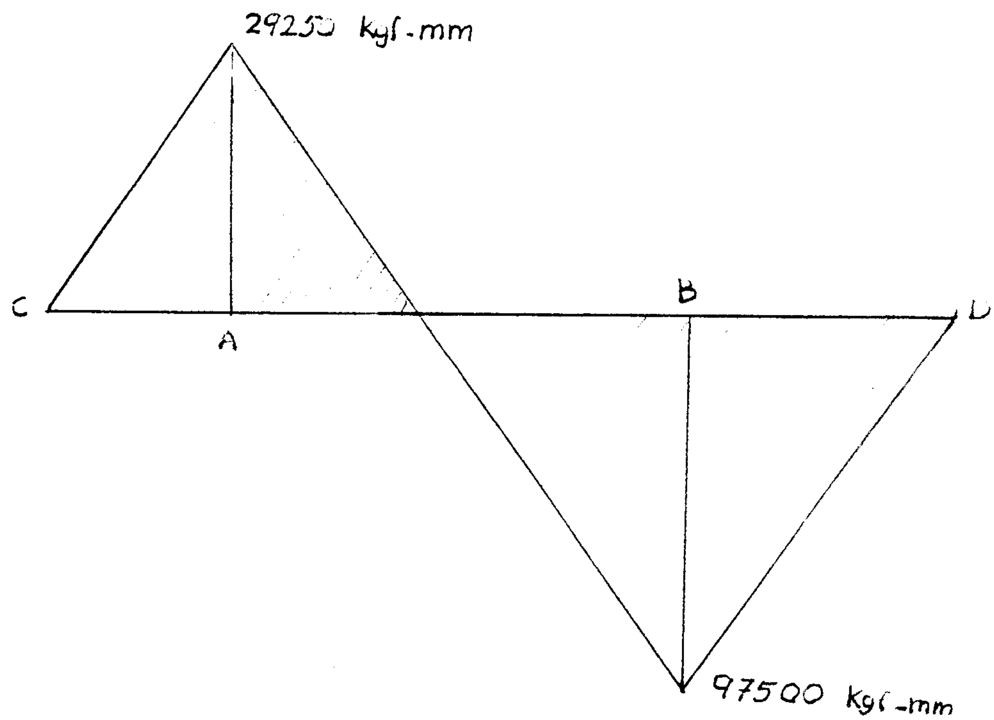
$$R_A = -845 \text{ Kgf}$$

Bending moment at C & D = 0

Bending moment at A = 250 x 117 = 29250 Kgf mm

Bending moment at B = 250 x 117 - 150 x 845

= -97500 Kgf mm



Maximum Bending moment = 97500 Kgf mm

$M = 97.5$ Kgf m

$D = 39.8$ Kgf m

$$T_{eq} = \sqrt{M^2 + T^2} = 105.3 \text{ Kgf m}$$

$$M_{eq} = 0.5\,(M + \sqrt{M^2 + T^2}) = 101.4 \text{ Kgf m}$$

$$T_{eq} = (\pi \times fs \times d^3)/16$$

$$105.3 = 3.14 \times 9 \times 10^6 \times d^3 / 16$$

$$d = 39 \text{ mm}$$

$$M_{eq} = \pi \times (\sigma b) \times d^3 / 32$$

$$d^3 = 32 \times 101.4 / (\sigma b) \times 3.14$$

Taking Bending Stress Value

$b = 2700$ Kgf/cm^2

Factor of safety = 1.5

Hence $b = 1800$ Kgf/cm^2

$d = 38.54$ mm

Hence the minimum diameter selected is 40 mm.

CHAPTER V

PROCESS FLOW CHART

SN	COMPONENT NAME	MATL	M/C USED	OPER.	INSP. GAUGE
1.	Indexing Plate	EN8	L,D	F,T,B,D,R	VC,BDG
2.	Main Spindle	EN8	L	F,T	VC
3.	Spindle Housing	M.S	L	F,T,B	VC,BDG
4.	Bearing Cap	M.S	L	F,T,B	VC,BDG
5.	Magazine Plate	EN8	L,D,s	F,T,D,S	VC
6.	Actuating Figer	HC HCr	L,G	F,T,G	VC
7.	Actuating Plate	EN8	L,D	F,D,T	VC
8.	Cam	MS	L,S	F,T,S	VC
9.	Cam Shaft	EN8	L,M	F,T	VC
10.	Cam Housing	MS	L	F,T,B	VC,BDG
11.	Bracket	MS	S	S	VC
12.	Bevel Gear Shaft	EN8	L	F,T,B	VC,BDG
13.	Mounting Brackets (Bevel Gear shaft)	MS	S,W	S,W	VC
14.	Bush	MS	L	F,T	VC
15.	Pivoting Arrangements	MS	GC,W, D,S	GC,W, B,S	VC
16.	Locking Pin	EN8	L	F,T	VC
17.	Housing	MS	L,W,S	T,F,S,D,W	VC
18.	Bush (Bevel shaft)	PB	L	F,T,D,B	VC,BDG

19. Screw rod	EN8	L,W	F,T,D,B,TC	VC,BDG,TC
20. Driving Pin	EN8	S,L	F,T,S	VC
21. Dovetail Wedge	EN8	S	S	VC
22. Eccentric Disc	MS	L,D	F,T,D	VC,EC
23. Shaft(Scragging unit)	EN8	L,W,D M	F,T,W,D,TC M	VC,TG
24. Plummer Block	MS	S,W,D L,G	G,S,W,B D,T	VC,BDG
25. Lock Nut	MS	L,S	F,D,S,TC	VC,TG
26. Screw Rod (for dovetail)	EN8	L,S	F,T,TC,S	VC,TG
27. Adjustable Nut	EN8	L	F,T,TC,B	VC,TG,IC
28. Screw Rod Housing Nut	EN8	L	F,T	MC,VC
29. Scragging Plate	MS	S,D,W B	S,D,W,B	VC,BDG
30. Slider	EN8	L,S	F,B,S	VC
31. Dovetail Wedge	EN8	S,D	S,D	VC
32. Frame	MS	S,D,W	S,D,W	SR

L-Lathe, S-Shaping, D-Drilling, W-Welding, s-slotting
G-Grinding, GC-Gas Cutting, VC - Vernier Calliper,
B-Boring, M-Milling, BDG - Bore Dial Gauge,MC-Micrometer.
TG-Thread Gauge, F-Facing, SR-Steel Rule, T-Turning,
EC-External Calliper, IC - Internal calliper,R-Reaming,

CHAPTER VI

COST ESTIMATION

S.No.	Components	Matl	Weight Kg.	Matl Cost Rs.	Labour Hours	M/Cing Cost Rs	Tot. Cost Rs
1	INDEXING PLATE	EN8	8.00	160.00	2.50	75.00	235.00
2	MAIN SPINDLE	EN8	10.00	140.00	1.50	45.00	185.00
3	SPINDLE HOUSING	M.S	3.00	50.00	0.75	22.50	72.50
4	BEARING CAP	M.S	4.00	80.00	2.00	60.00	140.00
5	MAGAZINE PLATE	EN 8	5.00	100.00	3.75	112.50	212.50
6	ACTUATING FINGER	EN 8	0.20	2.80	0.25	7.50	10.30
7	ACTUATING PLATE	EN 8	0.50	10.00	0.75	22.50	32.50
8	CAM	M.S	5.00	57.50	4.50	135.00	710.00
9	CAM SHAFT	EN 8	2.00	28.00	2.50	75.00	103.00
10	CAM HOUSING	M.S	2.00	26.00	0.75	22.50	48.50
11	MOUNTING BRACKET (FOR CAM HOUSING)	M.S	2.00	26.00	3.50	105.50	131.50
12	BEVEL GEAR SHAFT	EN 8	1.50	21.00	0.50	15.00	36.00
13	MOUNTING BRACKET(LEVEL GEAR SHAFT)	M.S	4.00	54.00	2.50	75.00	129.00
14	BUSH	M.S	1.00	13.50	0.50	15.00	28.50
15	PIVOTING ARRANGEMENT	M.S	2.00	27.00	3.25	97.50	124.50
16	LOCKING PIN	EN 8	0.50	7.00	0.50	15.00	22.00
17	HOUSING FOR LOCKING PIN	M.S	1.00	13.50	2.00	60.00	73.50

18	BUSH	P.BRO	3.00	525.00	0.50	15.00	540.00
19	SCREW ROD	EN 8	5.00	70.00	2.00	60.00	130.00
20	DRIVING PIN	EN 8	1.50	21.00	2.00	60.00	81.00
21	DOVETAIL WEDGE	EN 8	3.00	60.00	1.50	45.00	105.00
22	ECCENTRIC DISC	M.S	8.00	108.00	0.50	15.00	123.00
23	SHAFT	EN 8	7.00	98.00	3.75	112.50	210.50
24	PLUMMER BLOCK	M.S	8.00	104.00	4.50	135.00	239.00
25	LOCK NUT	M.S	1.00	13.50	0.50	15.00	28.50
26	ADJUSTING SCREW ROD	EN 8	1.50	21.00	0.75	22.50	43.50
27	ADJUSTABLE NUT	EN 8	3.00	42.00	0.75	22.50	64.50
28	SCREW ROD HOUSING NUT	EN 8	1.00	14.00	0.50	15.00	29.00
29	SCRAGGING ELBOW	M.S	1.50	19.50	7.75	232.50	252.00
30	SLIDER	EN 8	2.00	28.00	15.50	465.00	493.00
31	DOVE TAIL GUIDE	EN 8	10.00	140.00	15.50	465.00	605.00
32	FRAME	M.S	25.00	337.50	24.80	744.00	1081.5
*** Total ***							6319.8

BOUGHT OUT ITEMS

S.No.	COMPONENT	COST
1	"V" PULLEY (2 NOS)	500.00
2	SPROCKET(2 NOS)	80.00
3	PULLEY (GEAR BOX)	200.00
4	SCREWS M10 (37 NOS)	74.00
5	SCREWS M6 (30 NOS)	97.00
6	SCREWS M16 (2 NOS)	6.00
7	MOTOR	3600.00
8	REDUCTION GEAR BOX(WORM & WORMWHEEL)	5625.00
9	"V" BELT	280.00
10	COUPLING	120.00
11	MOTOR MOUNTING	175.00
12	BRACKET WITH SCREWS	175.00
13	STARTER	840.00
14	BINS (2 NOS)	150.00
15	CHAIN	760.00
16	BEVEL GEAR (1 PAIR)	100.00
17	BEARINGS 6210 DIA40(2 NOS)	300.00

18	NEEDLE BEARING	150.00
19	OIL SEALS	40.00
20	BED BOLTS	48.00
21	63 SERIES BEARING (2 NOS)40 DIA,50 DIA	190.00
*** Total *** 231		13510.0

TOTAL COST OF THE MANUFACTURED COMPONENTS - Rs. 6319.80

TOTAL COST OF THE BOUGHT OUT ITEMS - Rs.13510.00

ASSEMBLY CHARGES - Rs. 600.00

TOTAL COST OF THE SCRAGGING M/C - Rs.20429.80

CHAPTER VII

CONCLUSION

The scragging machine which was fabricated is found to perform the function of scragging effectively.

The scragging operation is quick. The synchronization of pressing and indexing is achieved. The scragging obtained is about 36 spring per minute as compared to 4 springs in the Arbor Press.

Thus due to automation of the machine an effective vise in the production is achieved.

Limitations :

1. As the spring have to be scragged thrice the operator has to wait for 3 rotations of the indexing plate.

2. It cannot be used for scragging heavier springs.

CHAPTER VIII

FURTHER DEVELOPMENTS

The pneumatic pressure can be used as a further development for scragging heavy springs more effectively.

A pneumatic cylinder can be installed to get reciprocating motion for scragging, instead of the eccentric drive. The scragging elbow can be attached to the end of the piston through the slider which moves up and down in a dovetail groove. The downward motion imparts required pressure for scragging the springs.

Four limit switches can be used for the control of scragging cycle. The actuation of limit switches control the Two Position Four Way Solenoid Direction Control Valve. Te other two are connected with the electromagnetic clutch. The Schematic diagram is shown in fig 1.2

The stroke of the ram is adjusted using two limit switches LS1. LS2. The Direction Control valve controls the flow of compressed air into the cylinder according to which the piston moves upward and downward and after completing the required stroke for scraging the spring to solid height, the lever actuates the limit switch. After receiving the signal the Directional Control Valve causes the ram to return upwards. Then the cycle of operation is repeated.

The same indexing mechanism with the following changes can be used.

i) A 1 H.P motor can be used for the power requirement.

ii) The motor can be connected to an electromagnetic clutch which receives signal from the two limit switches LS3 & LS4.

iii) The electromagnetic clutch can be connected to the reduction gear box.

iv) The reduction gear box is connected to the cam spindle through a flexible coupling.

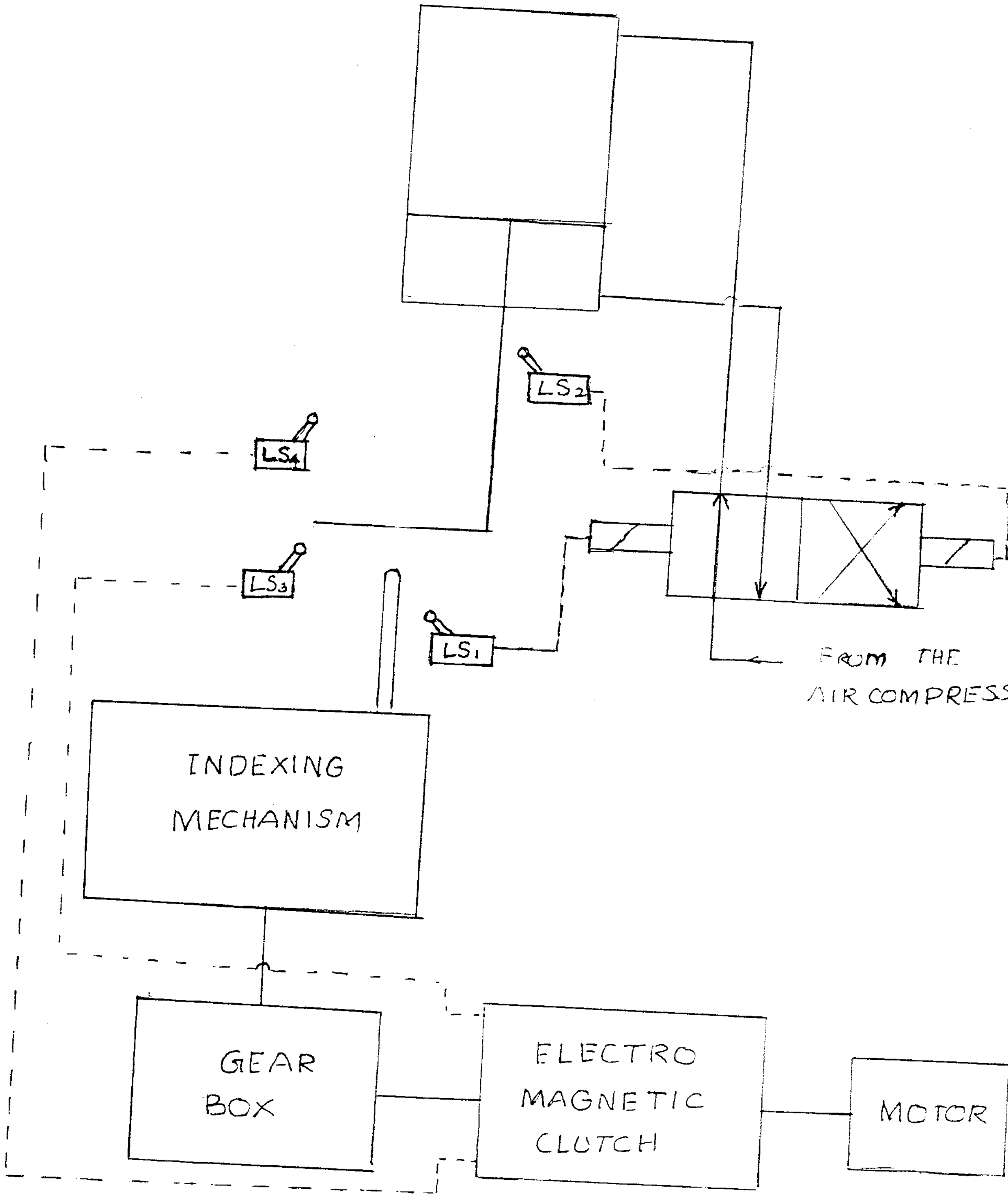
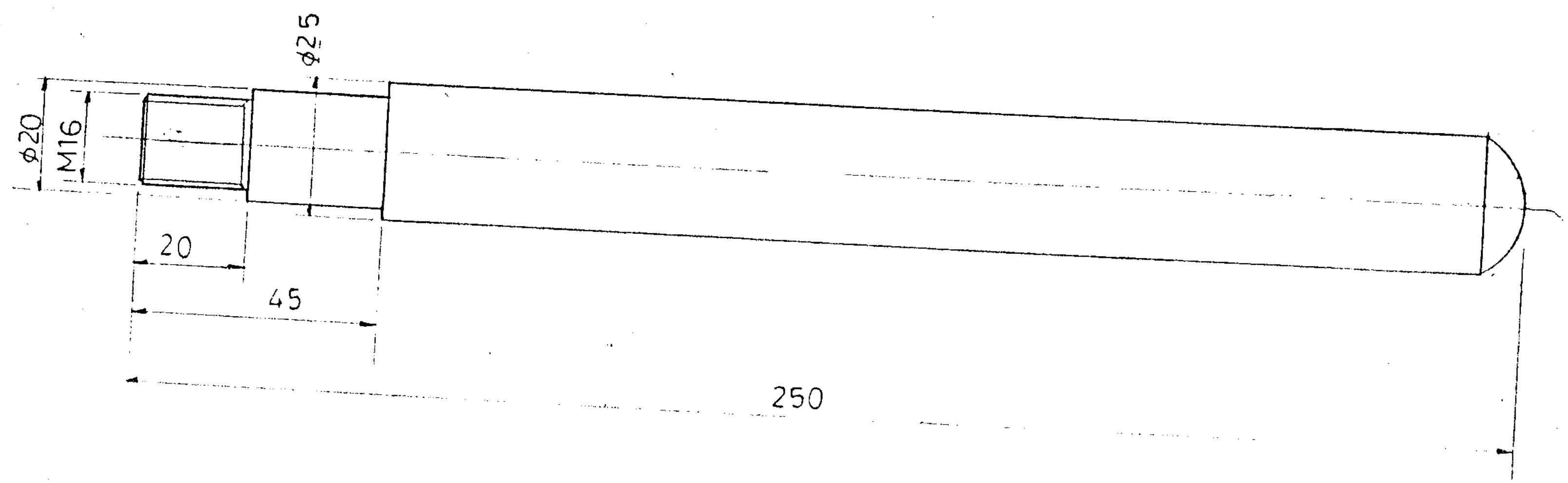


FIG 1.2 LINE DIAGRAM OF PNEUMATIC SCRAGGING MACHINE

BIBLIOGRAPHY

1. DESIGN OF MACHINE ELEMENTS - R.K.JAIN
2. MACHINE DESIGN - R.S.KHURMI
3. MACHINE DESIGN CMTI HANDBOOK
4. DESIGN DATA BOOK. COMPILED BY FACULTY OF MECHANICAL ENGINEERING , P.S.G. INSTITUTION
5. INTERMITTENT MECHANISM - JOHN BIGFORD
6. S.K.F BEARING CATALOGUE
7. PRODUCTION TECHNOLOGY - H M T
8. IS CODE BOOK 2102
9. COLD FORMED HELIGAL SPRINGS - K.F. FRIEDRICH STUMPP & GUSTAV WAGNER
10. ABC OF PNEUMATICS - STEWART L HARRY

DRAWINGS



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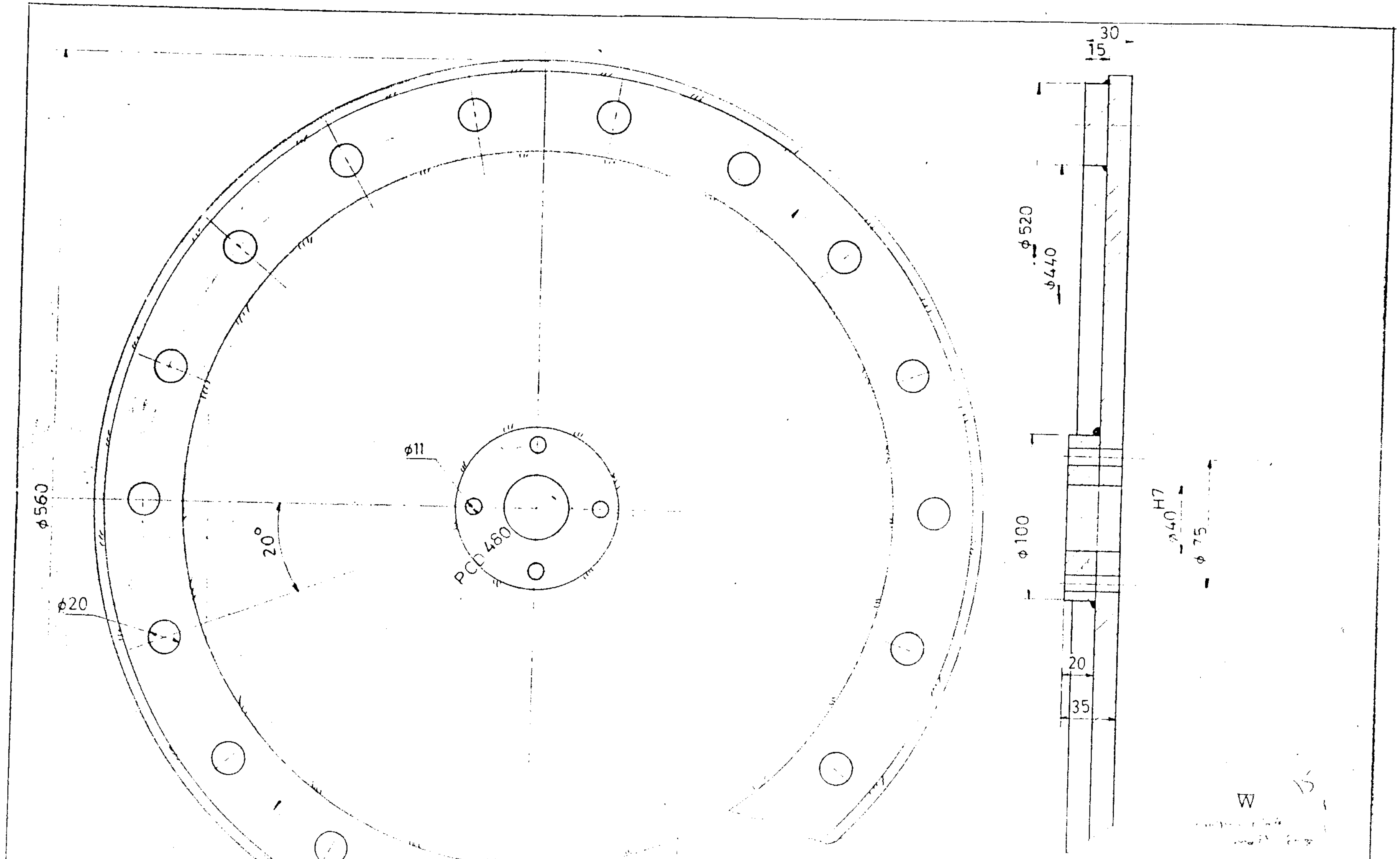

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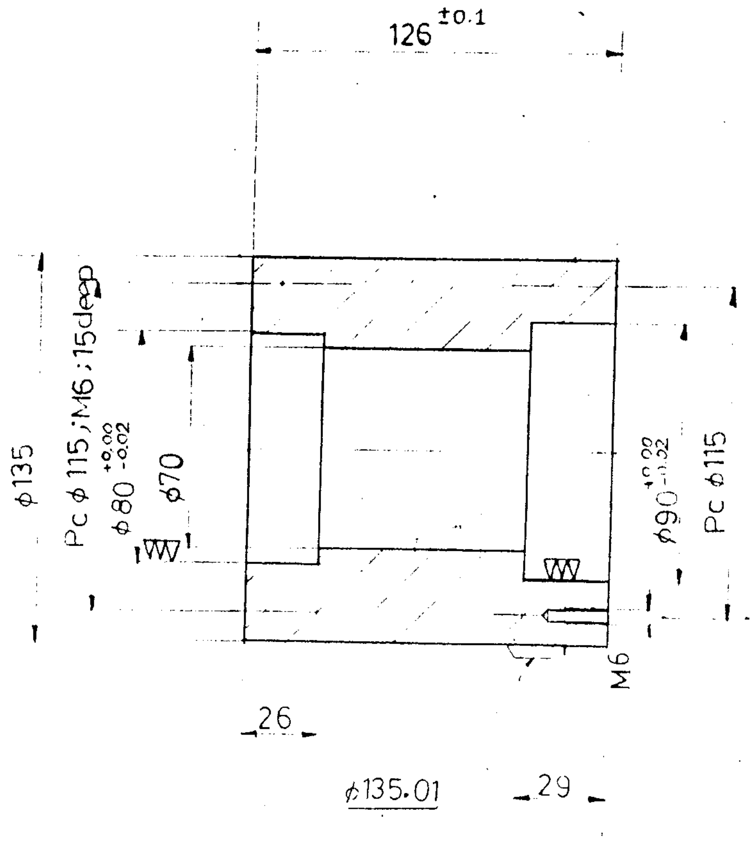

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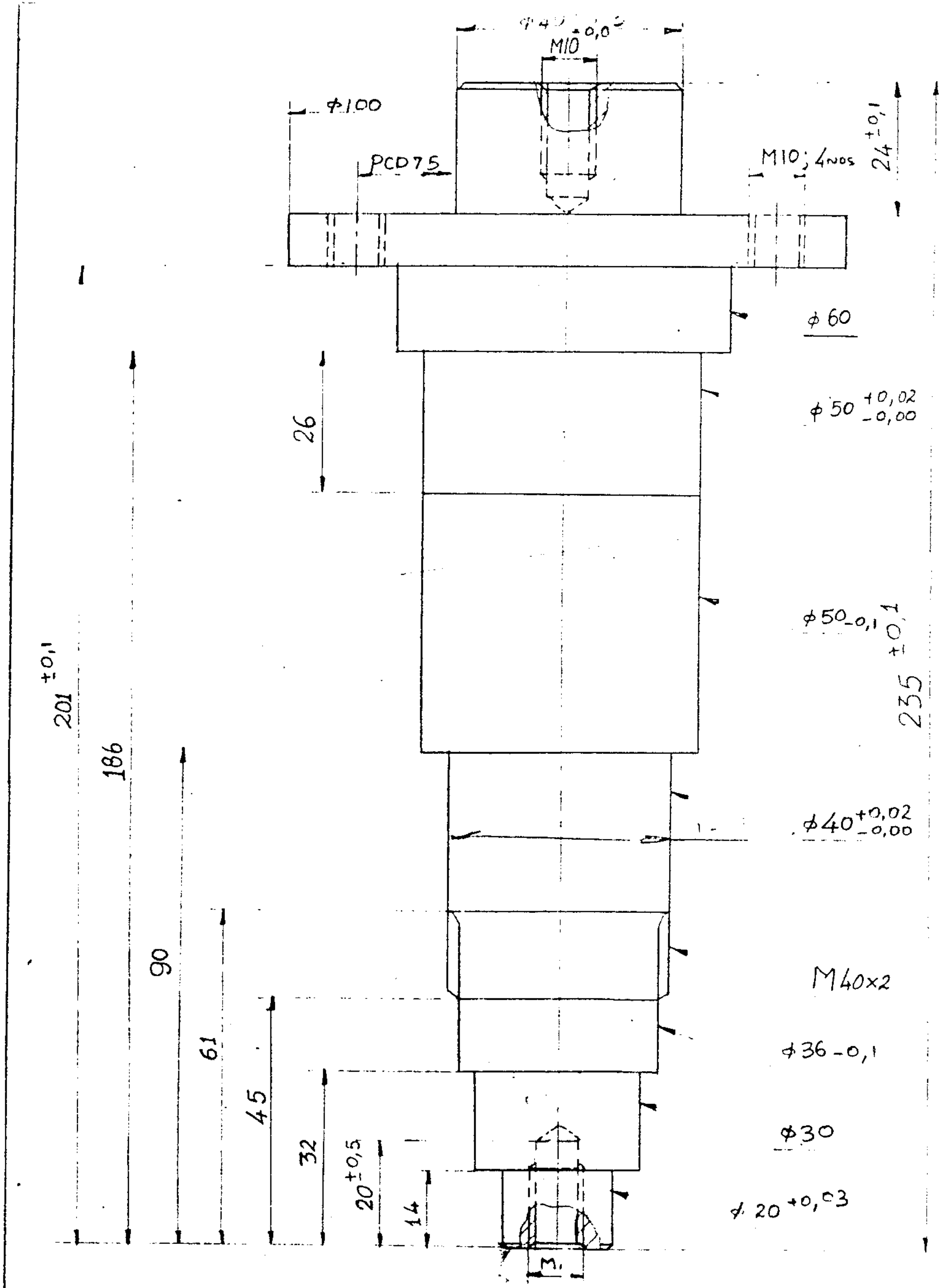
	Drawn				
	Checked				



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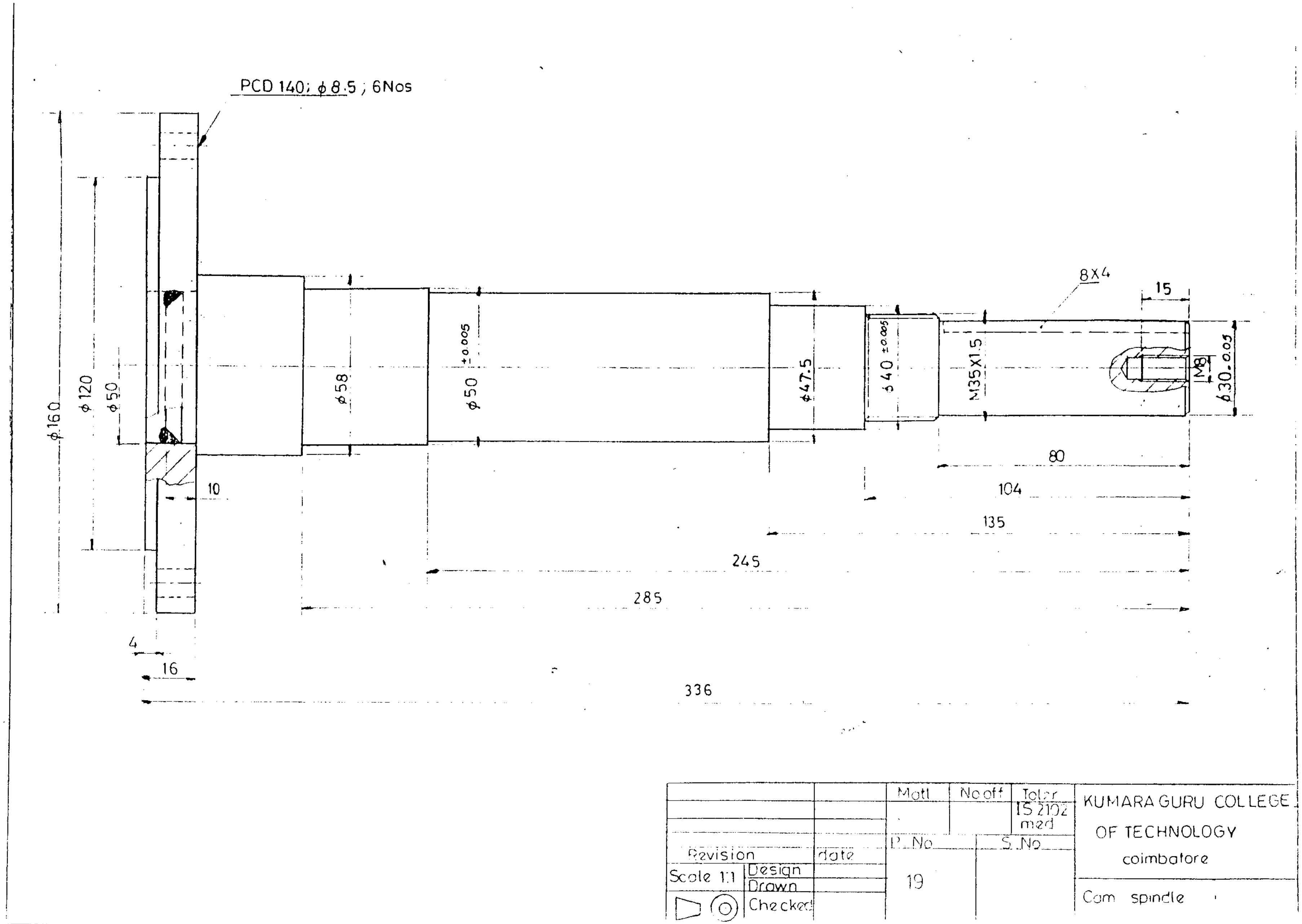
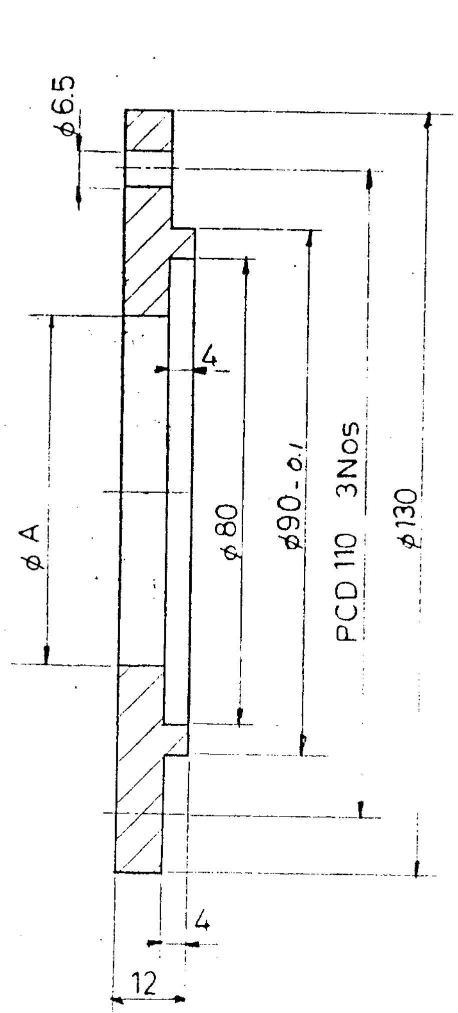
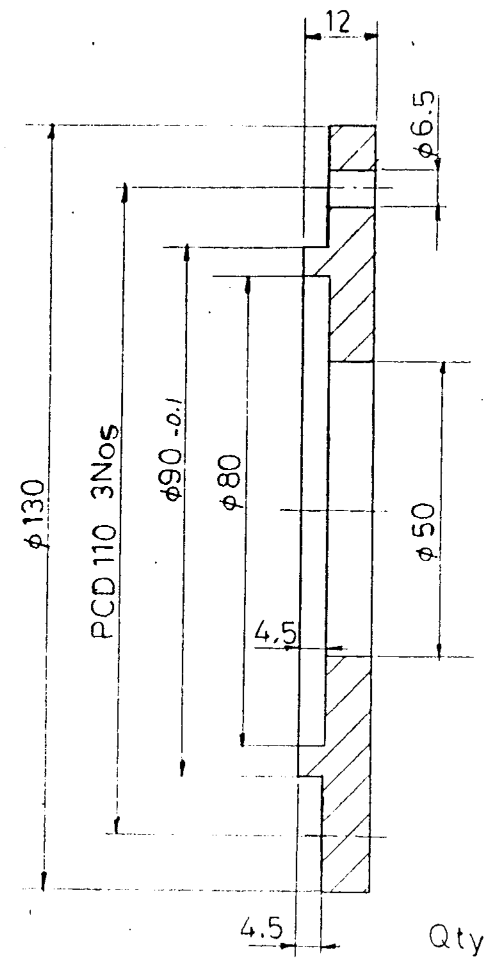
Revision	Date	P. no	S. no		
Scale 1:1 — Design / Drawn / Checked		18			MAIN SPINDLE


PCD 140; ϕ8.5 ; 6Nos
ϕ160
ϕ120
ϕ50
10
4
16
ϕ58
ϕ50 ±0.005
ϕ47.5
ϕ40 ±0.005
M35X1.5
8X4
15
M8
ϕ30-0.005
80
104
135
245
285
336
Matl
No off
Toler IS 2102 med
KUMARA GURU COLLEGE OF TECHNOLOGY
coimbatore
P. No
S. No
19
Revision
date
Scale 1:1
Design
Drawn
Checked
Cam spindle





Qty : 2Nos

Sno	φA	Qty
1	φ60	1
2	φ50	1

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		ms	4	IS2102 med	
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Drawn	[illegible]	22, 23			
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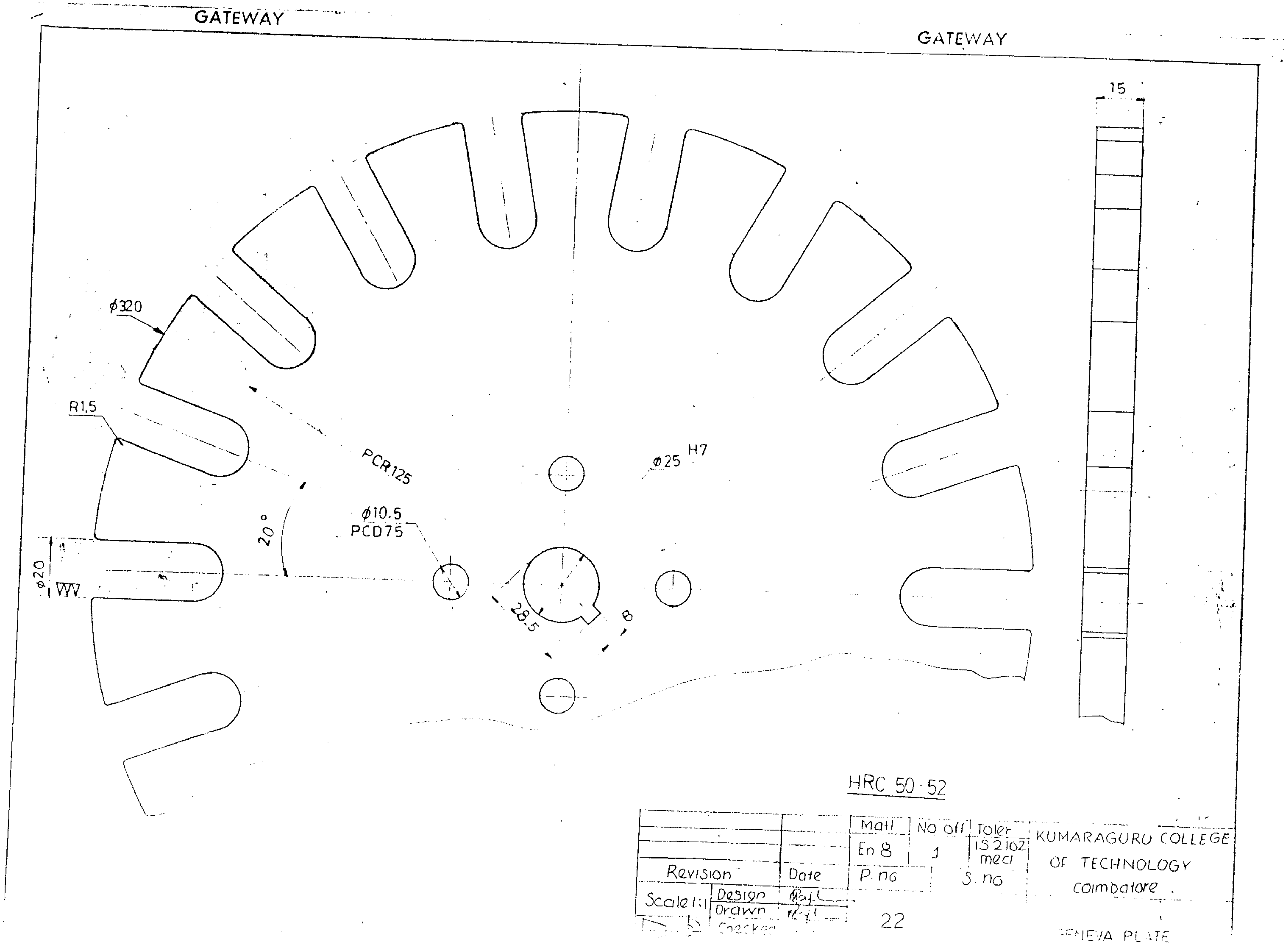
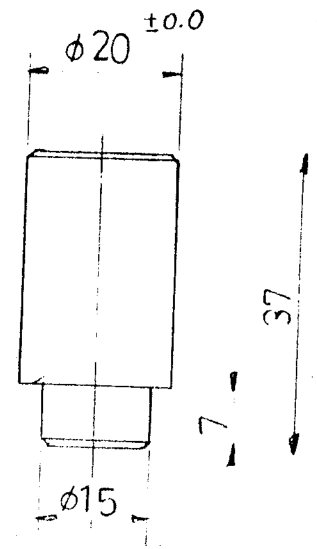

GATEWAY
GATEWAY
15
ϕ320
R1.5
PCR125
ϕ25 H7
ϕ10.5
PCD75
20°
ϕ20
28.5
8
HRC 50-52
Matl
No off
Toler
En 8
1
IS 2102
medi
P. no
S. no
Revision
Date
Scale 1:1
Design
Drawn
Checked
22
KUMARAGURU COLLEGE
OF TECHNOLOGY
coimbatore
GENEVA PLATE



HRC 50-52

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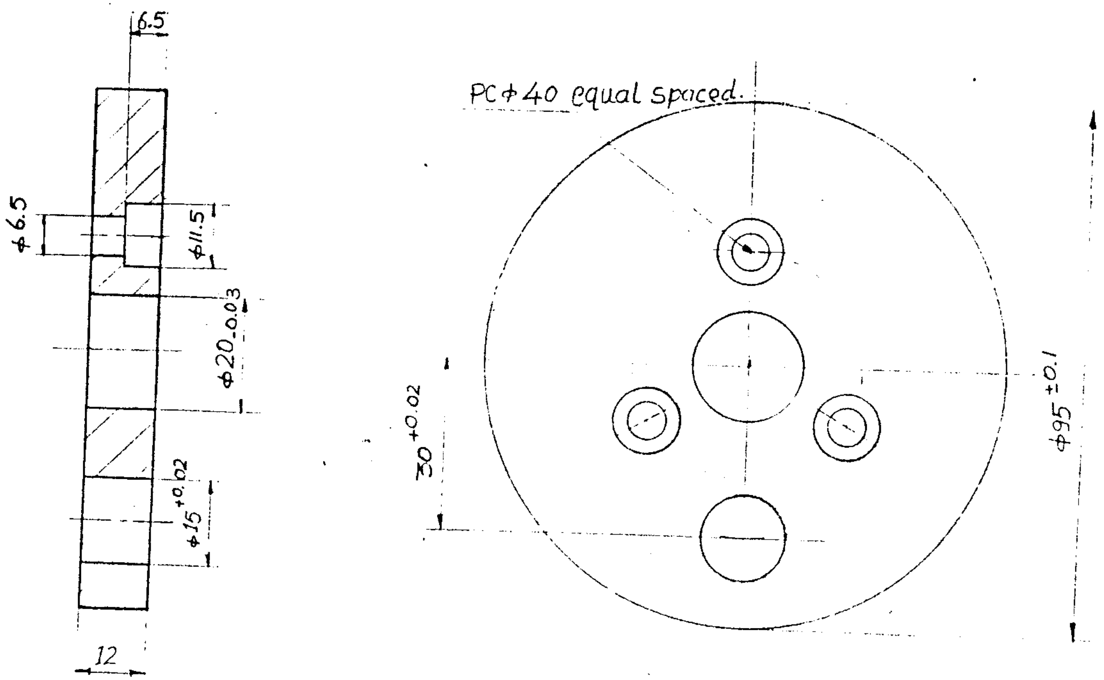
	Checked				



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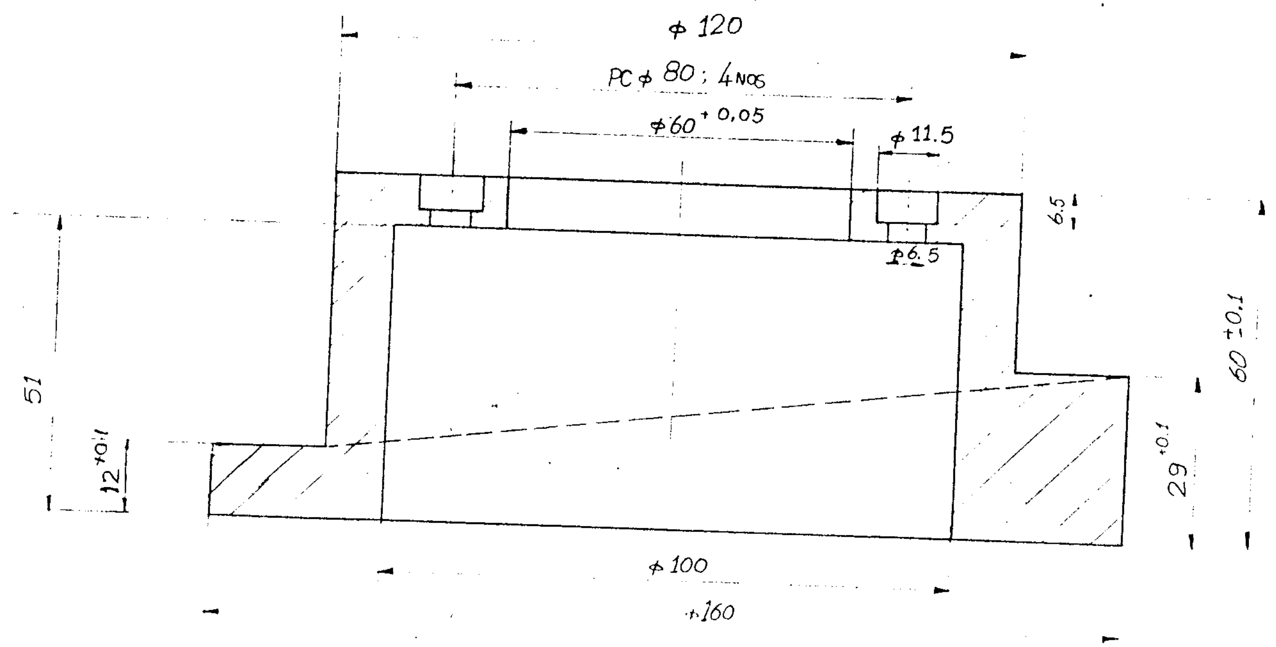
	Drawn				
	Checked				



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		MS	1	IS 2102 med
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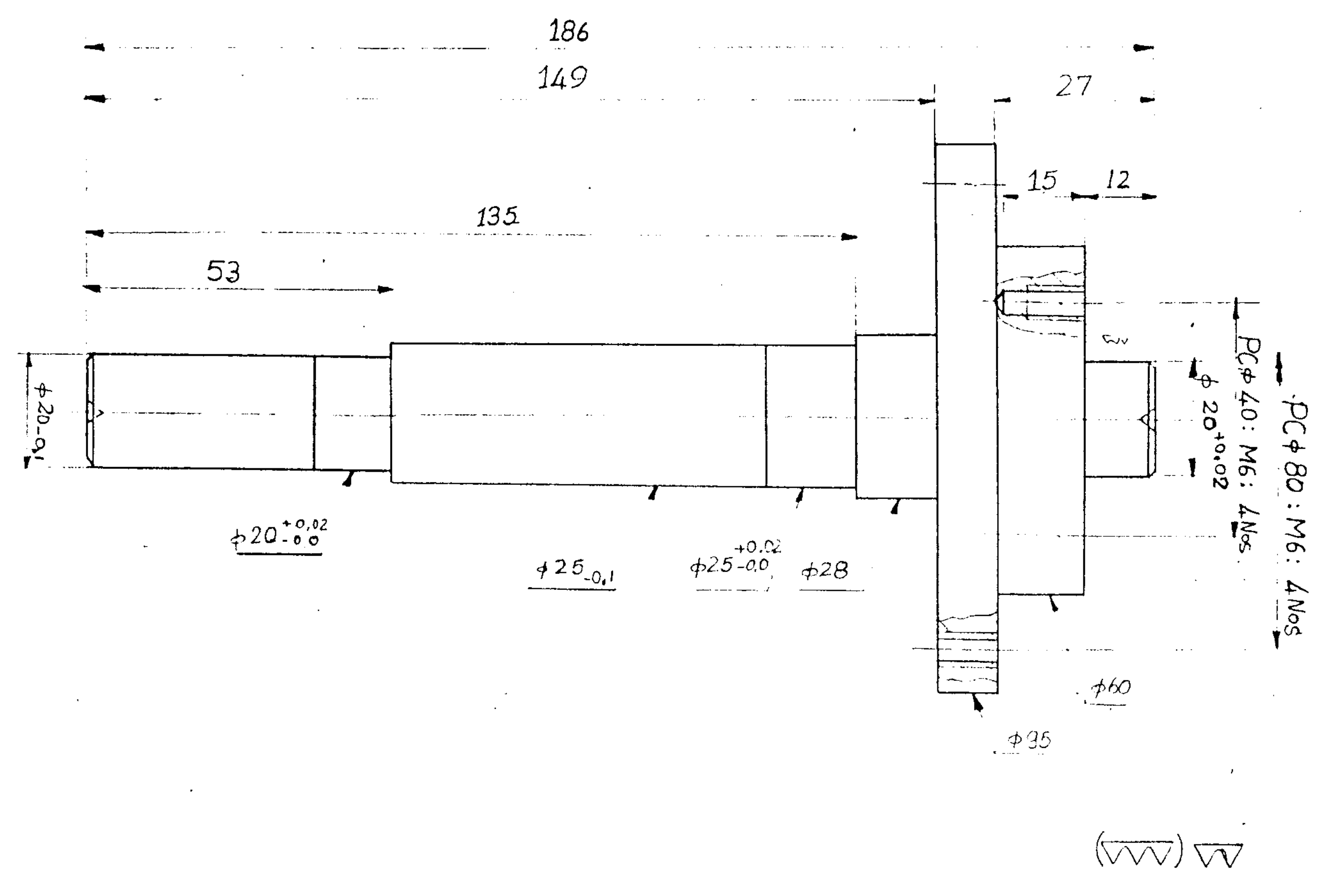
Scale	Design / Drawn / Checked	25		

KUMARAGURU COLLEGE OF TECHNOLOGY
Coimbatore

CAM



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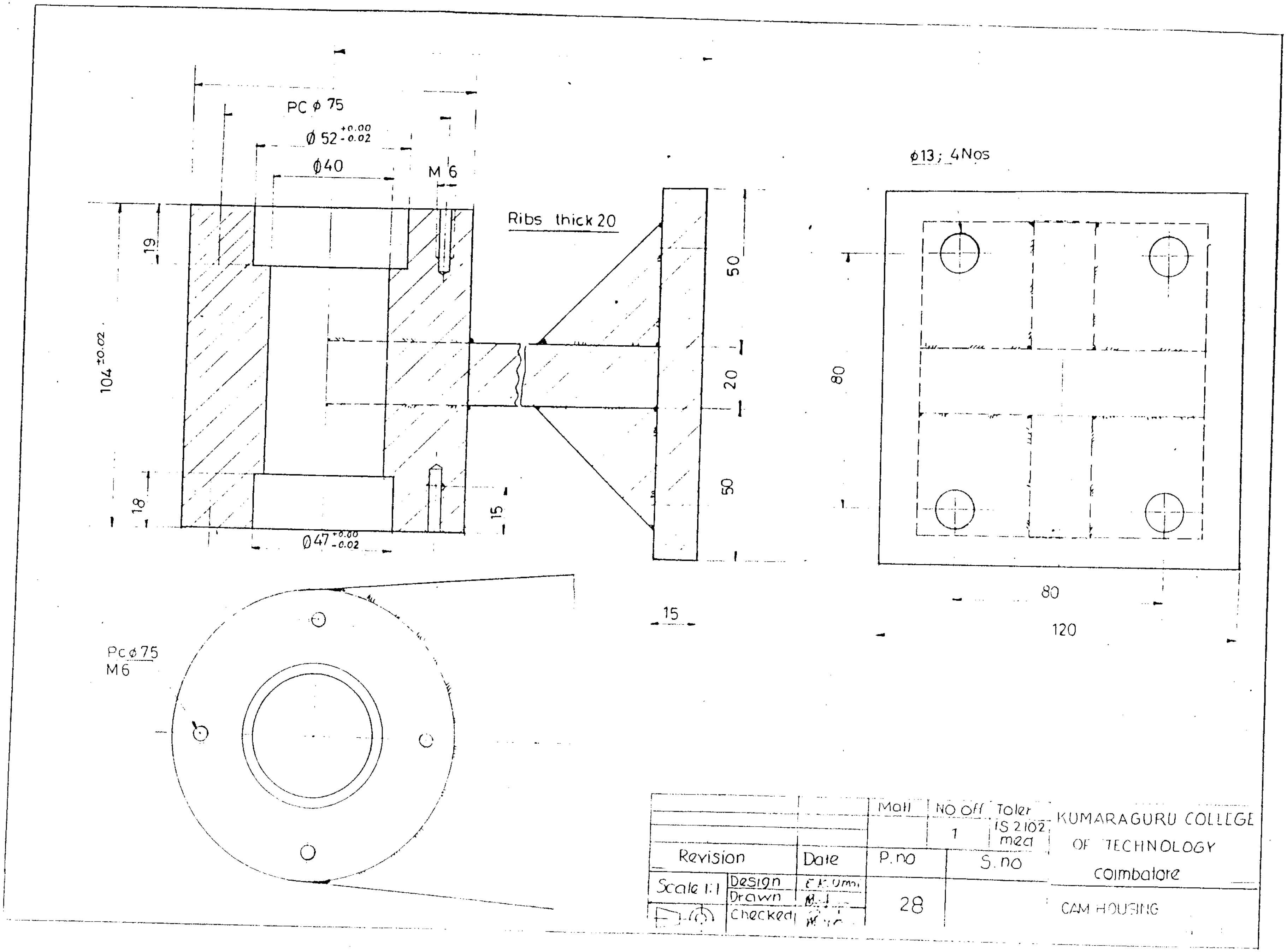
Revision	Date	P. no	S. no		
Scale 1:1 / Design / Drawn / Checked		27			CAM SHAFT


PC ϕ 75
Ø 52 +0.00 -0.02
Ø40
M 6
19
104 ±0.02
18
Ø47 +0.00 -0.02
15
Ribs thick 20
50
20
50
15
ϕ13; 4Nos
80
80
120
Pcϕ75
M6
Revision
Date
Matl
NO off
Toler
IS 2102
med
1
P.no
S.no
28
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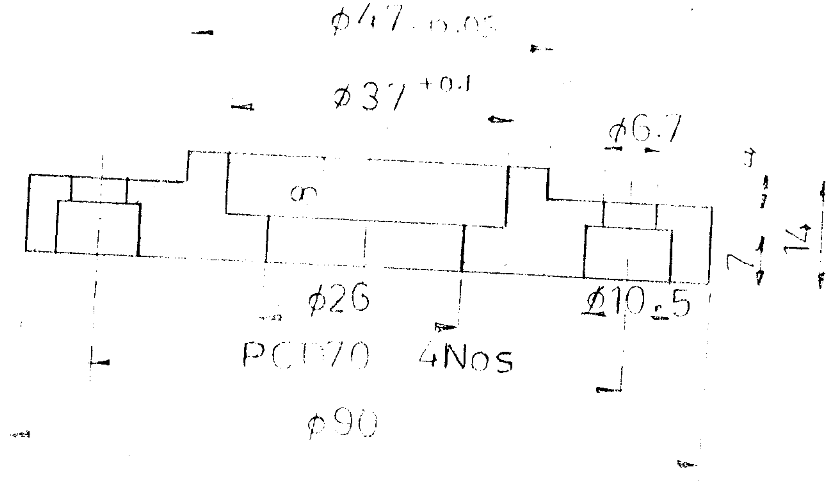
KUMARAGURU COLLEGE
OF TECHNOLOGY
coimbatore
CAM HOUSING



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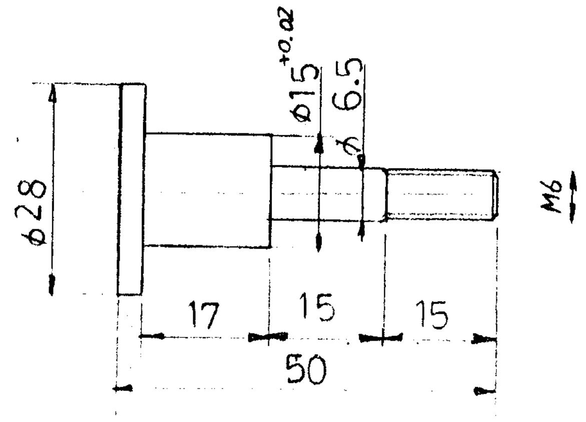
Scale	Design Drawn		P.no		S. no	BEARING CAP (counterboring)
	Checked		29			



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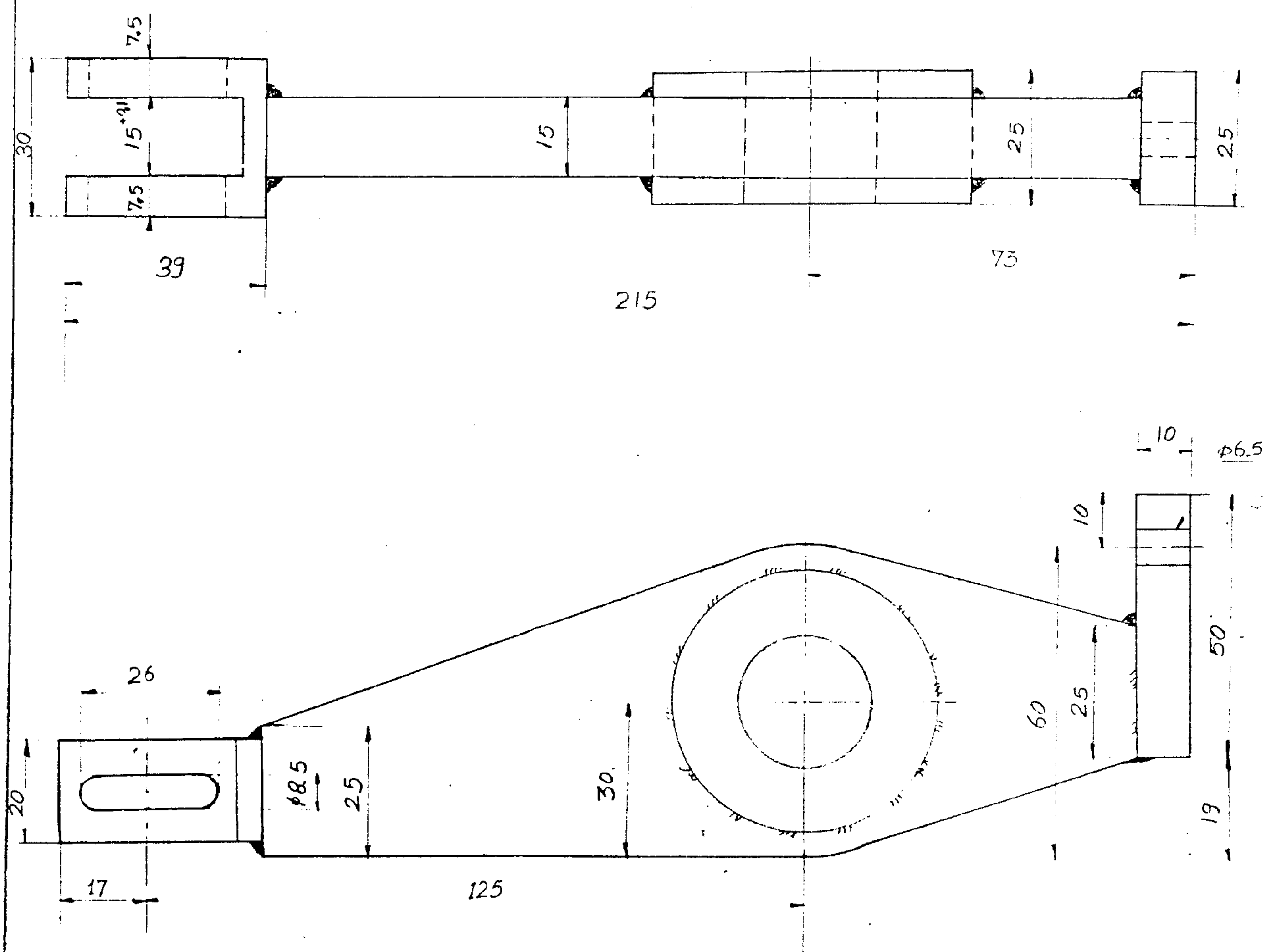

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Revision	date	P. no		S. no	
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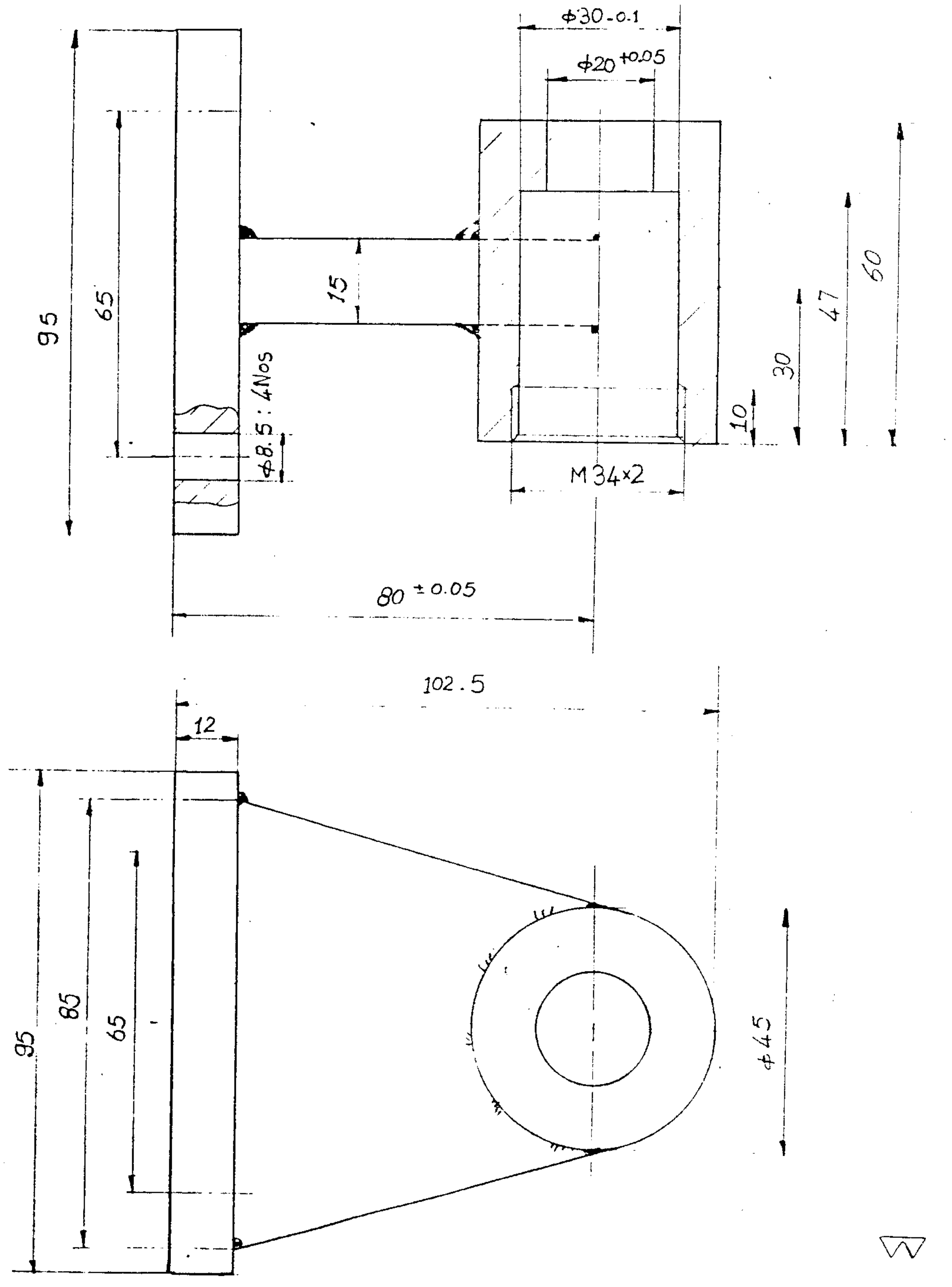

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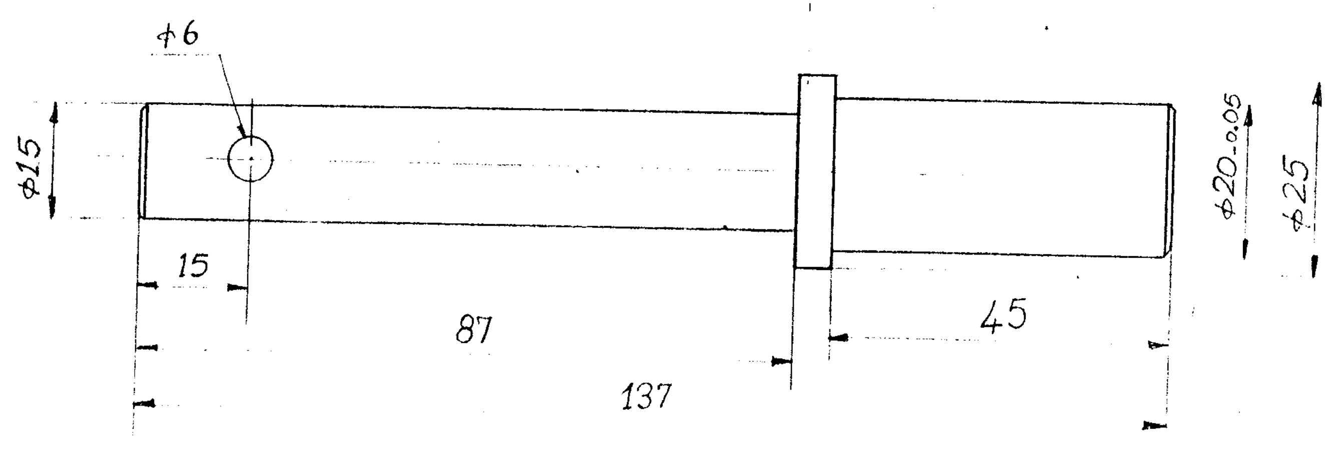

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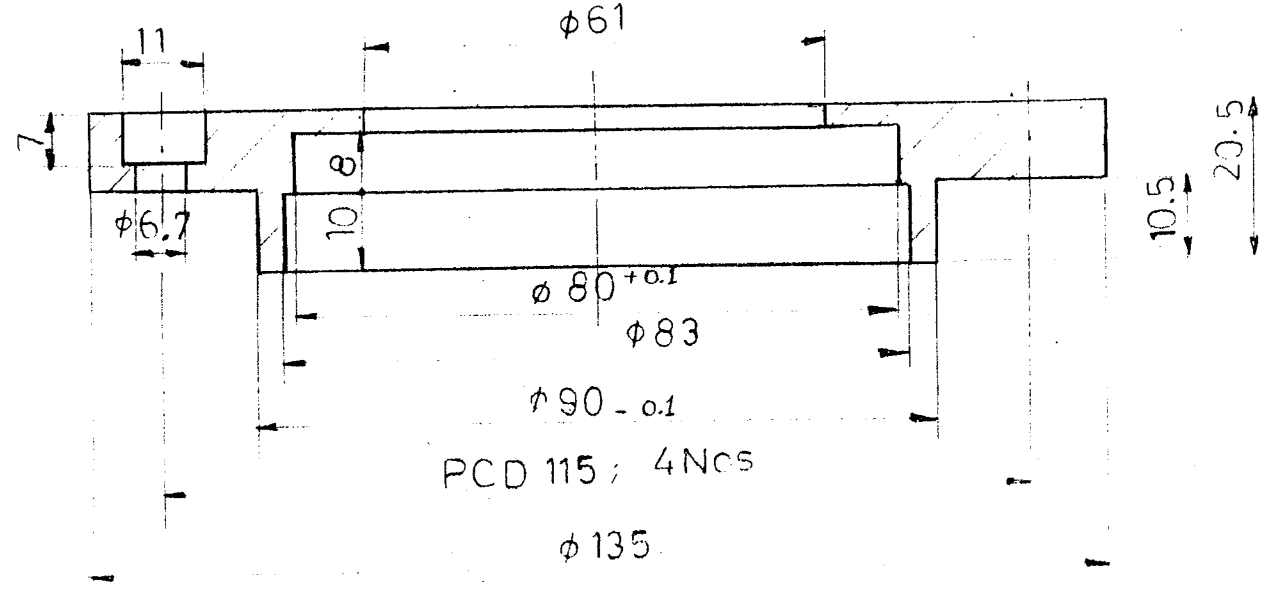

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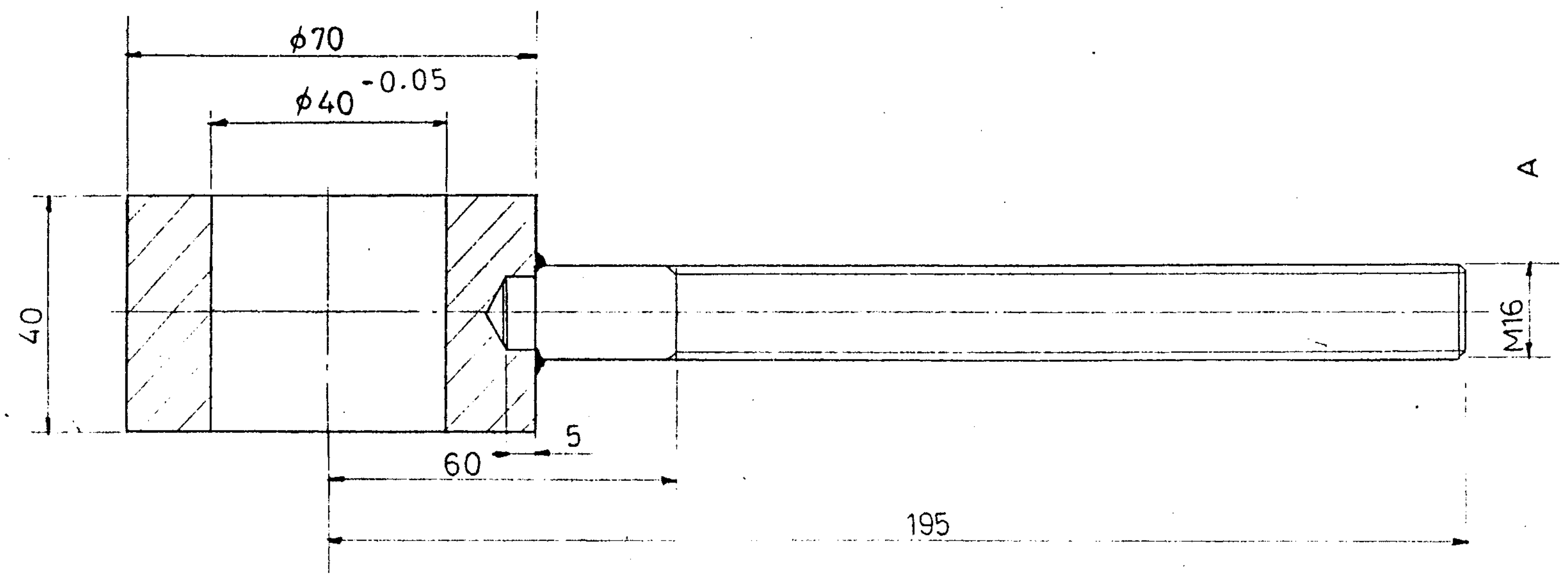

M 16 A [RH : 1 No; LH : 1 No]

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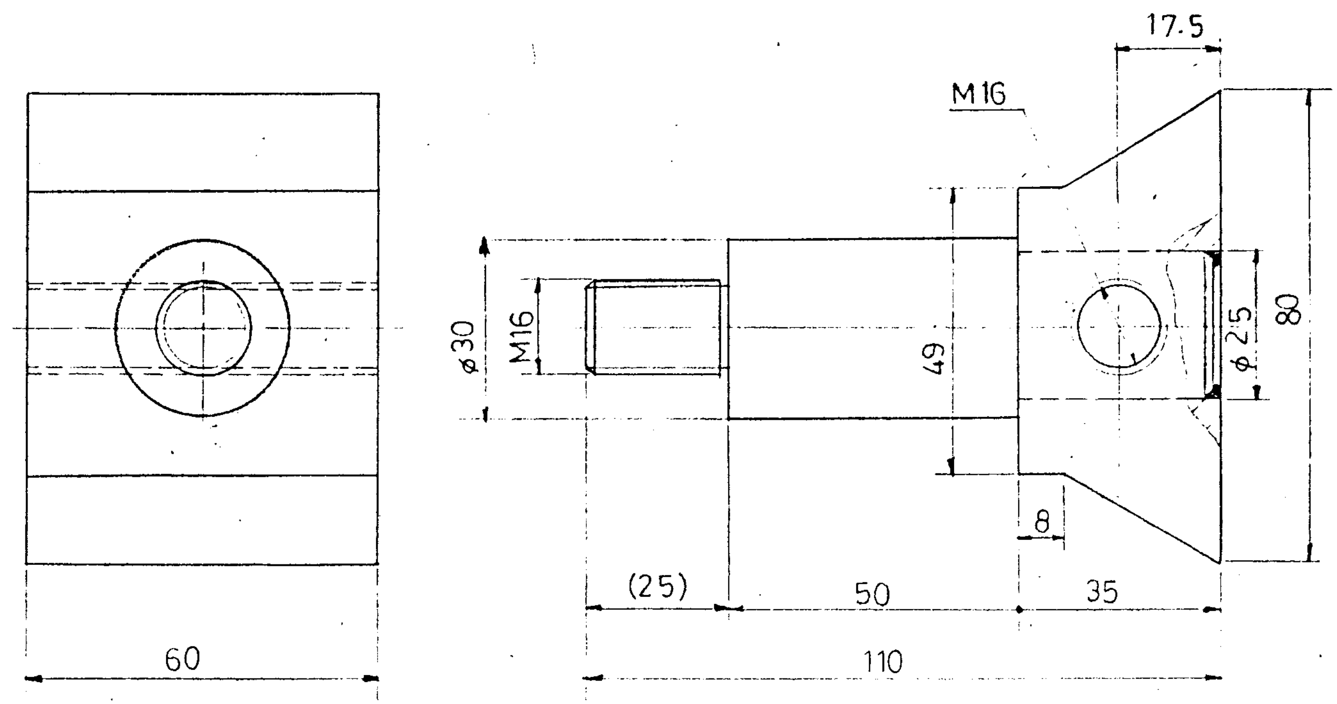

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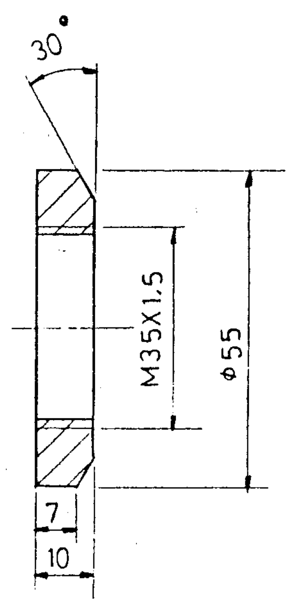

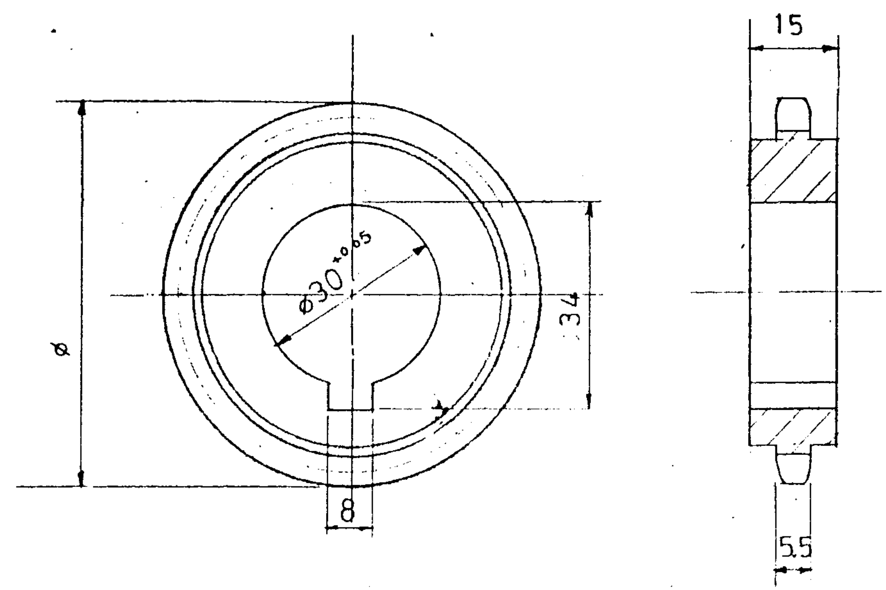

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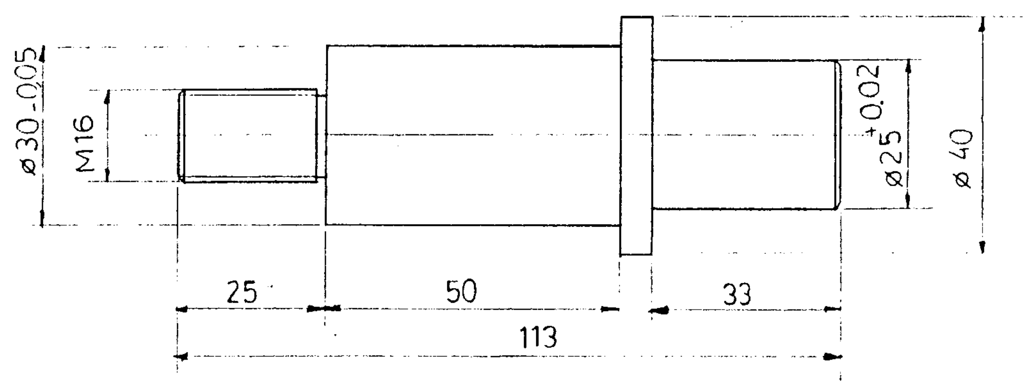

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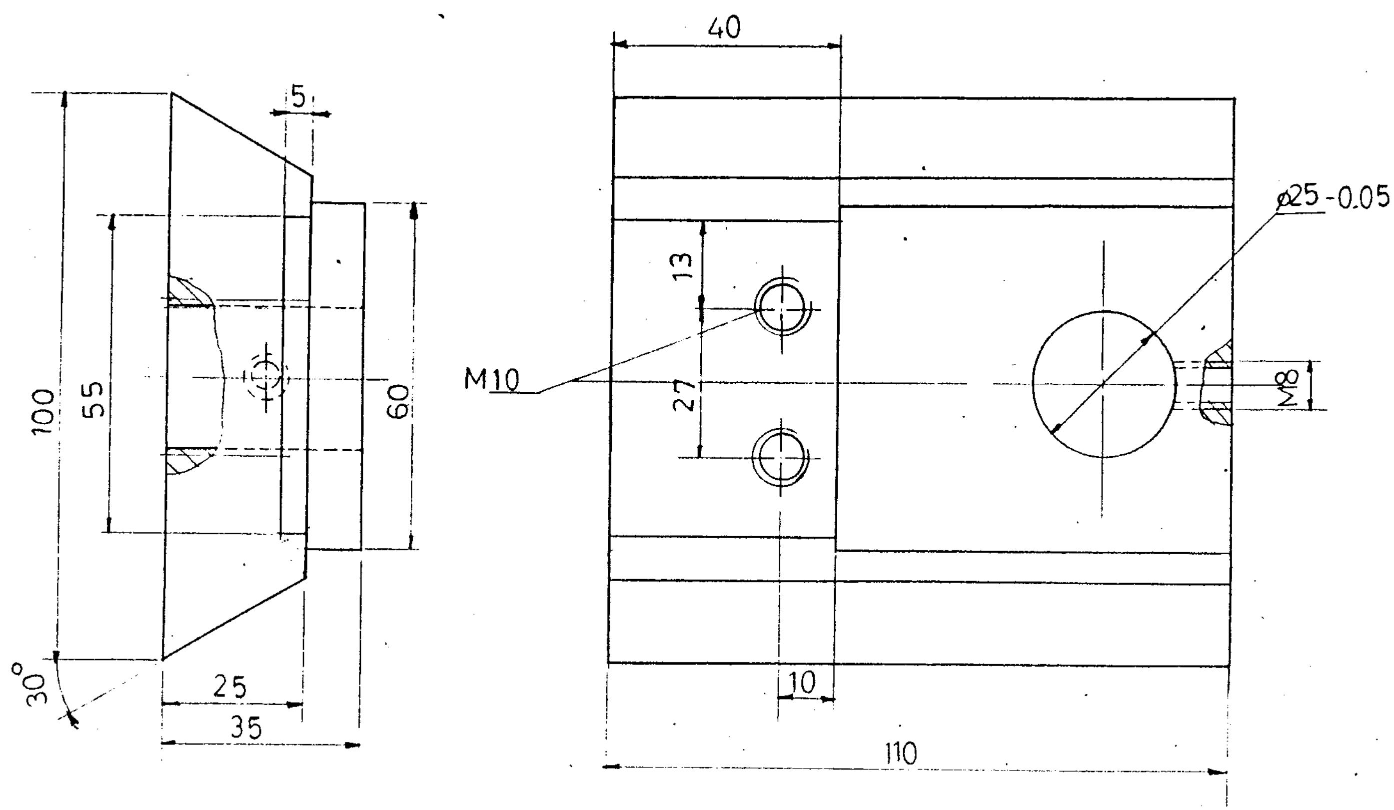
Checked					



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	Drawn				
	Checked				