VERTICAL MILLING MACHINE MANUAL

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INSTRUCTION MANUAL

I. A REQUEST :

Before starting to operate the Universal Milling Machine the operator should carefully read this working instruction and make himself acquainted with the design of the machine, method of operation and work safety rules.

The contents of the Operation Manual must also be known to the foreman, the instructor, head of the Machine shop and the head of the repair and maintenance shop.

NOTE: The design of our machine is subject to continuous development and, therefore, this Operation Manual is valid only for the machine with the corresponding serial number.

ORDERING FOR SPARE PARTS

List of spare parts for Milling Machine have been illustrated separately with reference to drawing of general view and sub assemblies for particular Model of each machine.

While ordering for spare parts please quote part No. and reference Drawing No. From the illustration with Serial No. Of corresponding Model of machine supplied. This would help us to pay quick attention to your requirements.

II. GENERAL VIEW OF THE MACHINE

General view of the Universal Milling Machine for production milling with a light administrative grey color looks very nice and a selected one for production shop and tool rooms of a reputed engineering company and plants. The construction of the machine has been designed for heavy duty job works of milling operations. Appearance and machine controls are kept centralized and symmetrical for good out look with easy operation.

III. DESIGN FEATURES

1. Main Motor :

Main Drive Motor to be used 2.2 K.W. and 3 HP foot mounted. Main Drive motor is kept in column housing on base plate mounted with columns to provide belt tightening provision with a hinge. Motor and main pulley are of 2 Grooves V-Belt Section B-63 having sufficient arc of contact to achieve maximum out put efficiency and mechanical advantage.

2. The Column :

The column is box type rigid high grade casting with stiffening ribs at inside and frame moulding at all openings of the body. It has been provided with a Oil sump at top for lubrication of main drive gear box and spindle. Front of the column has a closed rigid knee vertical bearing surface and top with a horizontal dove tail bearing for over arm. The column base has a thick mounting frame in side at bottom for clamping with base casting. Bottom half of the column is kept hollow to accommodate main motor and electrical system with a opening at back to pass motor inside the column.

3. Over Arm :

Over arm is a ram type hollow casting. It has a dove tail slide at bottom ends to mount an Arbor supports for spindle bearing.

4. Main Spindle :

The main spindle has been made from carbon steel having hardened and ground to resist wear and tear for long life. It has been provided with a standard ISO-40 taper nose at front and slots at taper neck to accommodate and lock of cutter adopters. It has been also kept hollow through hole to pass the draw bolt for clamping of cutter holders. A hexagonal nut & collar washer have been mounted at back to lock the draw bolt. Slight movement can be given to spindle easily from tail.

5. Over Arm Brace :

It is a solid casting with a bearing slot for slide block fixed at front end of the arm. Base of the Arm Brace is having dove Tail Shape of slide to mount on Knee Top bearing at front.

6. Lubrication :

Main Spindle : Main drive gear box and shaft bearing have been lubricated by an gear pump set on a shaft and supplying oil through copper pipe to the spindle gears forcibly from oil sump provided below main gear box in column housing. Bottom shaft/gears are running in oil bath and Lubricating intermediate shaft and gears through self Lubrication.

7. High Grade Casting :

Properties of casting for the whole machine are of high grade casting with a grade of Rockwell Hardness. Main parts specially the working table of milling machines contain a special property of alloys for long life & to with stand against Wear and tear.

8. Base Plate :

Base casting is a rigid hollow base plate having coolant reservoir in whole base. A coolant pump accommodation has been provided in casting at left side. Front face of the base is a square shape having cored hole at centre to accommodate telescopic screw. Flange mount nut at top face at center will also serve the purpose of knee support. Foundation bolt holes & setting bolts provision have been made at left & right side.

9. Knee Casting :

Knee casting is a box shaped hollow casting. It has a dove tail bearing ways at top and back for vertical and cross traverse feed by hand. Telescopic screw is serving as knee support. Telescopic screw gives up & down Motion of knee with help of four start worm & gear.

10. Knee Support :

A support of screw & nut is provided in front of knee with hollow bush. Knee support prevents cross word down bearing support to knee back side for vertical traverse.

11. Feed Box :

Feed Box is an Oil Contained Gear Box. It is opened at the right side to remove the cover for assembly and inspection. It is fixed at right side of the body with lever.

12. Knee Saddle :

Knee saddle is a solid casting dove tail bearing ways at bottom only. It has a table rotary bearing provision at top with help of T slot.

13. Table Saddle :

Table bearing saddle is also a solid casting having dove tail table bearing ways at top and table rotary, bearing system at bottom. Which have provision to tilt 25° Both side.

14. Table :

Table is a solid casting having dove tail bearing ways at bottom and plain surface at top with Three T-Slots & Two V at both end in longitudinal. Bottom bearing ways are having table screw accommodation at centre in whole length of table.

IV. INSTALLATION :

1. Inspection :

Machine has been thoroughly inspected after completion and finishing at works. A test certificate from the inspection, department of works has been given after final checking as per prescribed Test charts of Milling Machine. The machine bearing surfaces opened have been covered by antifriction grease to protect from rust. Whole machine is covered by the water proof plastics hood of machine size. Base of Wooden packing case bolted to machine base to avoid vibration occurred in Transport. General handle and standard accessories are fastened at table by the bolts & nuts. Direction of machine top is kept clear on outside of wooden case by black paint to handle the machine case with care. Inspection is also necessary at the place of unloading- at transport so that the damage report may be claimed in time in case of breakage in transport.

2. Transport (Loading and Unloading) :

For transport on railcars the machined surfaces of the various assemblies of Milling Machine are protected with anticorrosive coating, and the machine is secured on the platform by means of wooden beams. The equipment is packed separately in cases which are also fastened to the platform.

The method of suspending parts and assemblies or the whole machine by means of hook and ropes. To prevent possible accidents these methods of suspension should be adhered to strictly. The bridge crane capacity and the strength the employed lifting ropes must also be taken into account.

Both transportation and unloading must be effected carefully, without jobs. After arrival of the machine at its destination, it should be inspected externally and then the contents of the shipment should be checked.

Any shortage or transport damages must be ascertained by a commission, taken down in form of a claim, and forwarded to the transporters of the machine.

3. Cleaning & Lubrication :

Machine should be cleaned first before Direction so that leveling may be checked properly on bearing surfaces, i.e. Vertical & Horizontal. Coat of antifriction grease should be removed from all finished surfaces before leveling.

4. Erection & Foundation :

Foundation should be made according to foundation plan sent with machine. A platform 25 mm above floor level should be laid in which half inch thick plate be grouted below leveling bolts of the machine to level afterward. Projection of the foundation Bolt should be kept according to the Base plate casting bolt holes and cavity provided for nut and leveling bolt. A slinging diagram is sent in the manual for erection of machine of platform.
Machine base bolt holes should be kept straight to foundation bolt by hand while slinging the machine Rectangular solid washers should be kept below leveling bolt before refection to level the machine. Top of washers should be kept in level of platform by grouting in plastering. Spirit levels may be used to level the machine properly.

5. Grouting & Leveling :

Machine Foundation Bolt holes should be grouted in Cement Concrete 1:2:4 ratio after keeping the machine in position of platform. Foundation Bolts can be retained in Cement Concrete by the hole size plate of rod to be attached at Bottom. After setting foundation machine should be leveled accurately by leveling screws provided beside Foundation Bolt holes in base. Foundation Bolt *Nuts* should be properly tightened after leveling the machine.

6. Electric Supply Connections :

Main supply will be given to left side switch control Box from back through the flexible pipe.

V. OPERATION :

1. Machine Control Points :

1. Knee support lock nut.
2. Knee support jack.
3. Knee lock handle.
4. Knee wedge setting bolts.
5. Belt tighting rod &nuts (Invisible).
6. Oil draw plug main gear box.
7. Sight glass main gear box oil level.
8. Selected spindle speed lever.
9. Fast & Slow spindle speed lever.
10. Table angular movement lock nuts.
11. Cross movement wedge setting bolts.
12. Cross movement lock handle.
13. Knee up-down movement handle.
14. Table lock handle.
15. Table manual longitudinal travel hand wheel.
16. Table safety stop pins.
17. Table limit stopper.
18. Table wedge setting bolt.
19. Arbor Neck lock nut.
20. Arbor Support lock handle.
21. Spindle lock & limit switch.
22. Over arm lock handle.
23. Oil filler main gear box.
24. Draw bolt lock nut.(Arbor back side, Invisible)
25. Oil filler feed gear box.
26. Sight glass main feed gear box oil level.
27. Selected feed lever.
28. Oil draw plug feed gear box.
29. Universal Joint set.
30. Telescopic screw boss.

2. Test Run :

On completion of supply circuits machine should be started first for test run and to circulate the oil supply of lubrication and coolant system. There should be no load on machine for Test run. All the lubricating parts as shown on Lubrication diagram which should be well lubricated daily before operation.

3. **Starting the Machine :**

Before starting the machine an operator should follow all the working instructions supplied with the machine as a manual, Cautions as given on each gear box should carefully kept in mind by the operator. Speed change lever and safety stop dog of slide should be fixed in position according to the job and interlock Buttons of feed levers be kept at lock position on operation of machine. Spindle arbor as supplied with the machine should be fitted first for mounting cutter on it. Arbor supports will be kept on suitable position to serve as bearing end. A draw bolt is supplied with the machine to hold the arbor and cutter position on operation.

4. **Hand Feed :**

Manual feed are derived from front control points locating at right and middle of knee face by general handle for vertical traverse of knee and cross traverse of table. Table horizontal hand feed traverse is taken from Hand wheels at both ends of table. Arbor supports are positioned by hand sliding for spindle bearing lock pin Nut of Arbor support are located at right to look on position.

5. **Gear Specification :**

Gear specification is given for whole machine as per schematic diagram for main and feed drive. It will also help for replacement of any gear on requirement of easy location and serve the purpose of spare gear special parts illustration for kinetic system.

MATERIAL :

All gear made of carbon steel 20mn

Main drive gear box spindle & shafts :

Gear No.	No. of Teeth	No.of Module	Qty.
1	80	2.5	1
2	56	2.5	1
3	32	2.5	1
4	51	2.5	1
5	63	2.5	1
6	59	2.5	1
7	47	2.5	1
8	26	2.5	1
9	50	2.5	1
10	74	2.5	1
11	42	2.5	1
12	30	2.5	1
13	34	2.5	1
14	46	2.5	1

Feed Gear Box Shaft No.1&2

Gear No.	No. of Teeth	No. of Module	Qty.
1	36/26	2.5/2.5	1
2	20/31	2/2.5	1
3	16	2.5	1
4	45	2	1
5	26	2.5	1
6	21	2.5	1

Worm box & bevel shaft :

Gear No.	No. of Teeth	No. of Module	Qty.
1	21 Worm gear (Pb2)	8 DP	1
2	Single start worm wheel	8 DP	1
3	20 Bevel	3.5	1
4	20 Bevel	3.5	1
5	20 Bevel	3.5	1
6	20 Bevel	3.5	2

Vertical Movement Shaft :

Gear No.	No. of Teeth	No. of Module	Qty.
1	30 Worm gear (Pb2)	8 DP	1
2	Five start worm wheel	8 DP	1

STANDARD & SPECIAL EQUIPMENT :

Standard Equipment :

1. Spindle Arbor
2. Instruction Manual
3. Draw Bolt
4. Handle
5. Tool Kit
6. Foundation Setting Bolt

Special Equipment At Extra Cost :

1. Vertical & Angular Milling Attachment.
2. Coolant Pump.
3. Coolant Stand.
4. Machine Lamp.
5. V-Belt.
6. Foundation Bolt.
7. Special Size Milling Arbor.
8. Milling Swivel Base Vice.
9. Universal Milling Head.
10. Universal Dividing Head.
11. Rotary Table.
12. Rack Cutting Attachment.

VI. CONTROLS :

1) Safety stop for table movement

Safety press pins are set at centre of table saddle for tripping of power feed on either direction of Horizontal traverse of table.

VII. COOLANT & LUBRICANT :

1. Coolant Supply :

Supply is taken to coolant pump through a transparent Plastic tube to check the water flow at nozzle. Return supply is also through a plastic tube being a flexible for traverse and swiveling of table.

2. Oil and grease specification :

Oil and Grease should be used of a quality machine oil lubricant with a viscosity at 50° C. Antifriction bearing grease should have a drip point not below 140° C. Specification for quality is given separately for use at different purposes. Use SERVO–57.

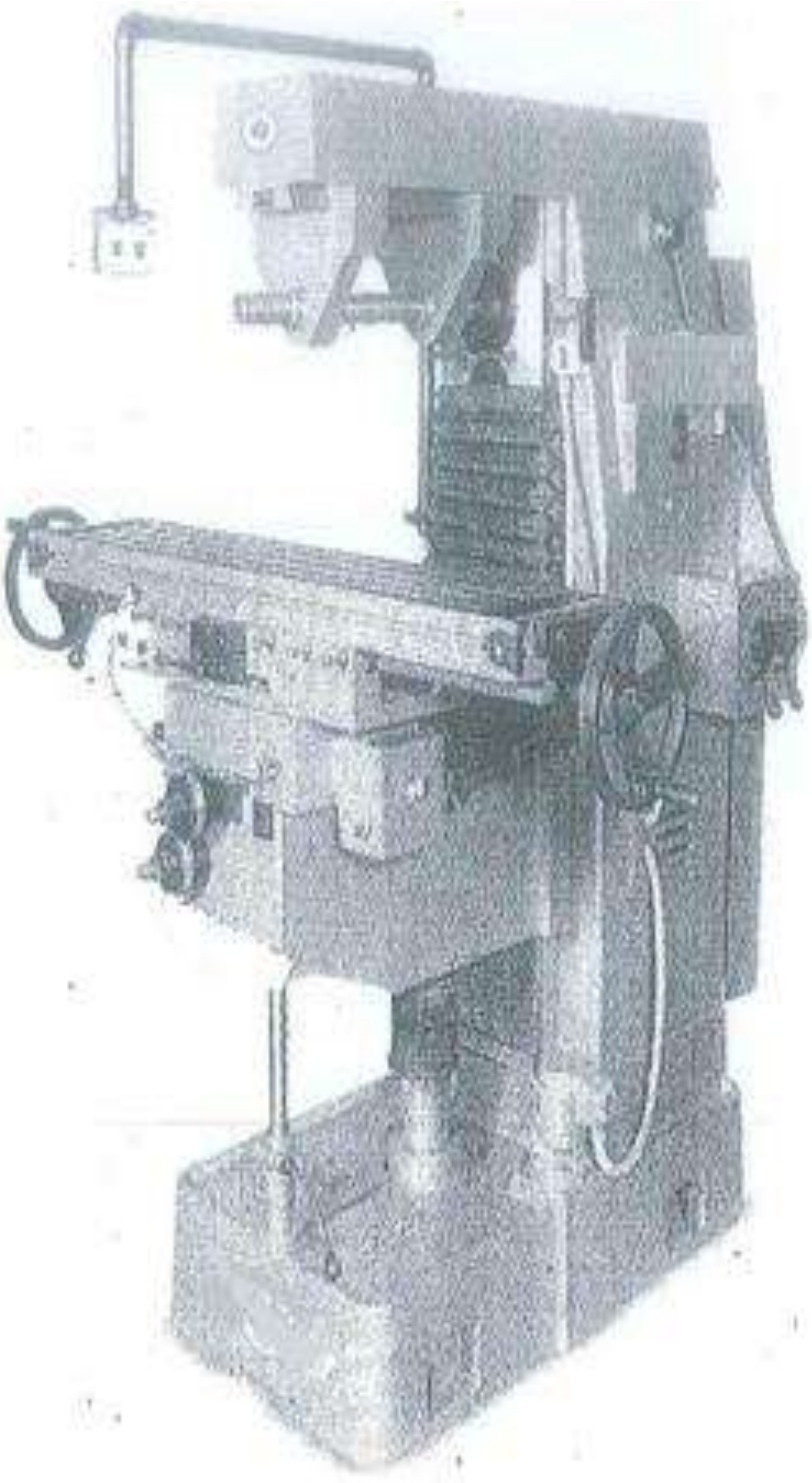
VIII. ELECTRIC EQUIPMENT :

1) Care and Maintenance of Motor :

An Electrical circuit diagram is supplied with the machine in addition to working Instruction Manual for fault checking in supply. Supply line should be earthed properly up to junction box.

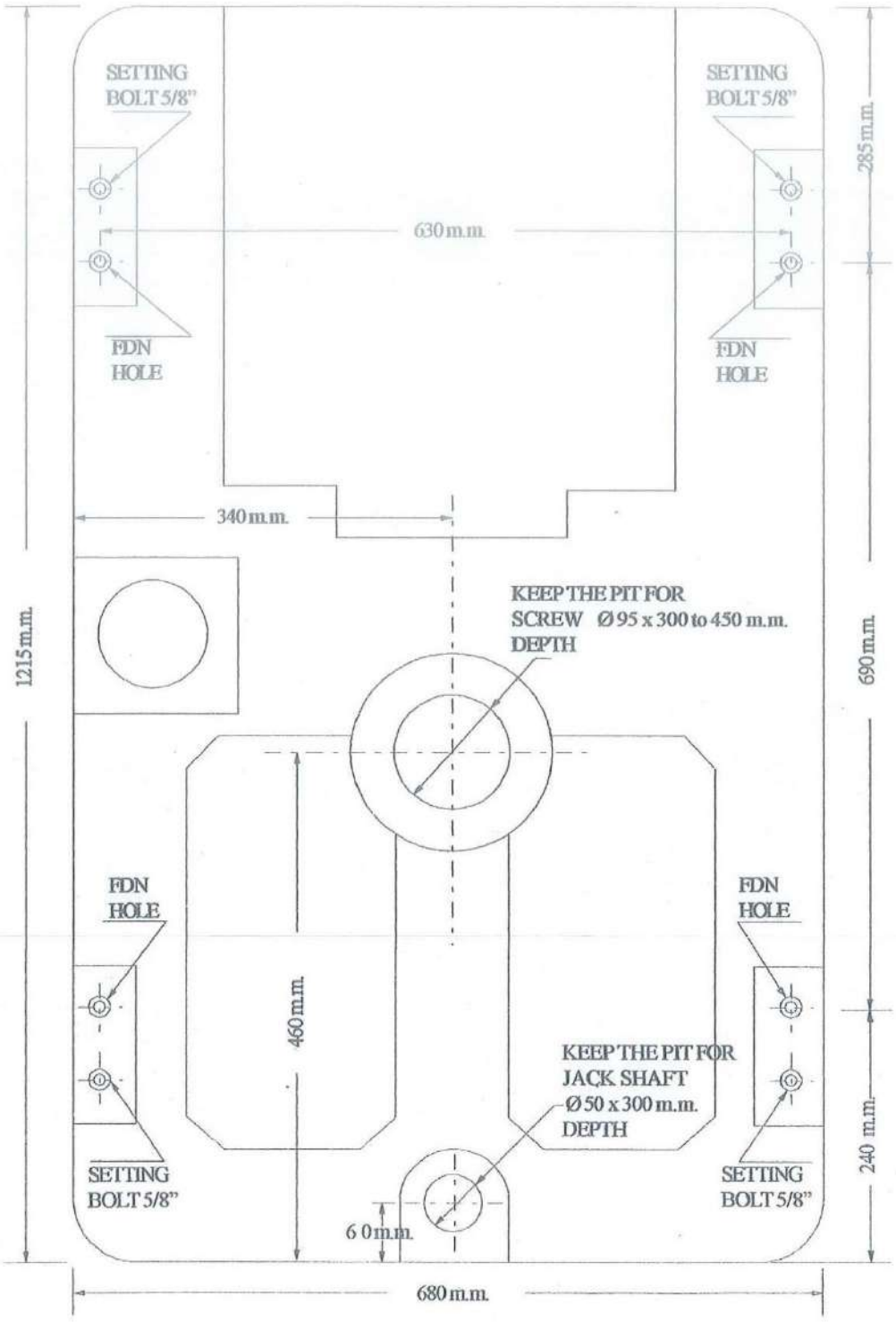
IX. LIST OF DRAWINGS :

MILLING MACHINE



Note : Illustration & specification are not binding in detail & are subject to modification & improvement without notice.

Fig. : 2- ERRECTION & FOUNDATION PLAN



FOUNDATION BOLT TO BE USED M16 (DRILL 21/32")

Fig. : 3- GENERAL VIEW SHOWING MACHINE CONTROL POINTS

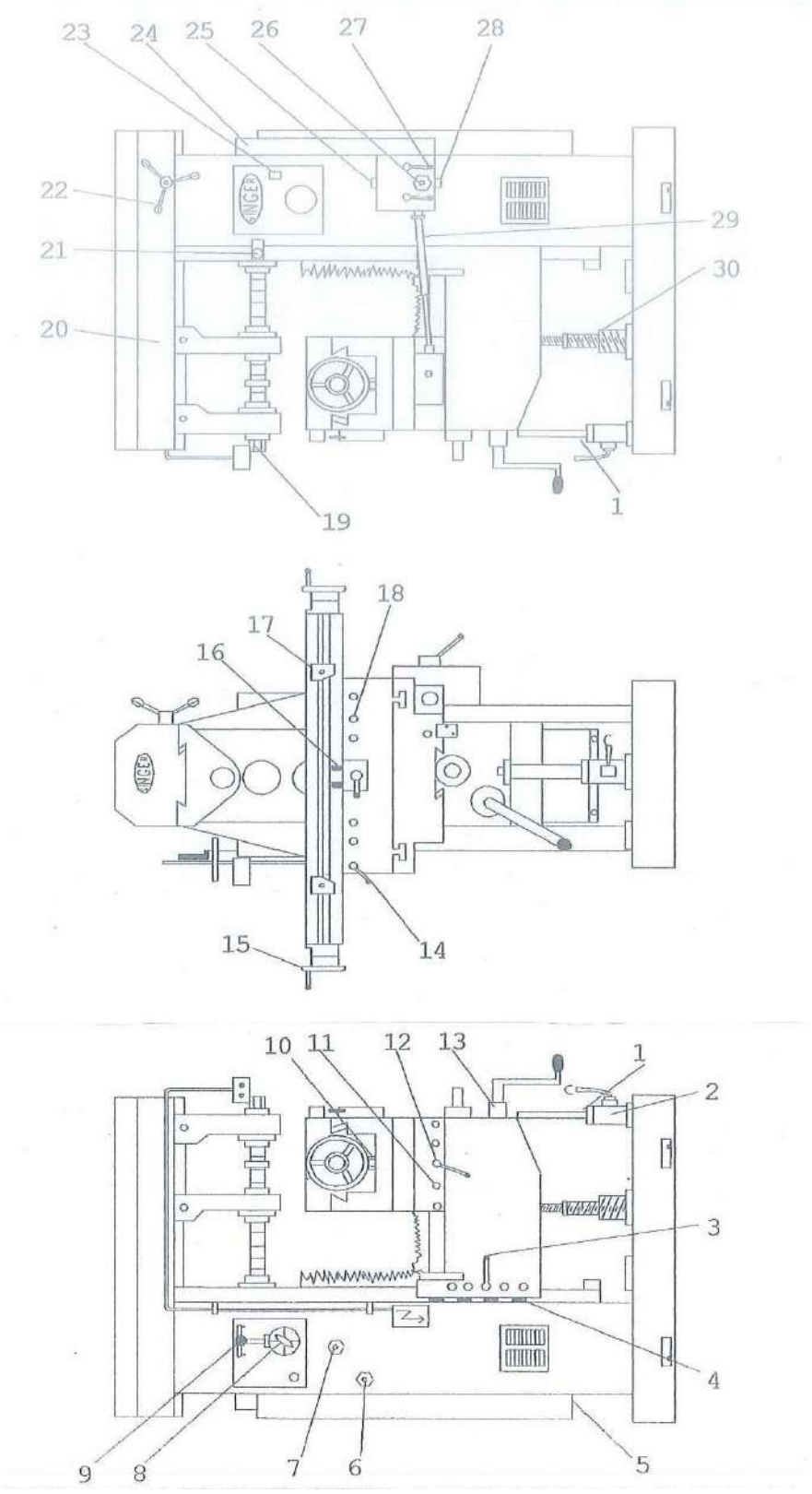


Fig. : 4- GENERAL VIEW SHOWING LUBRICATION POINTS

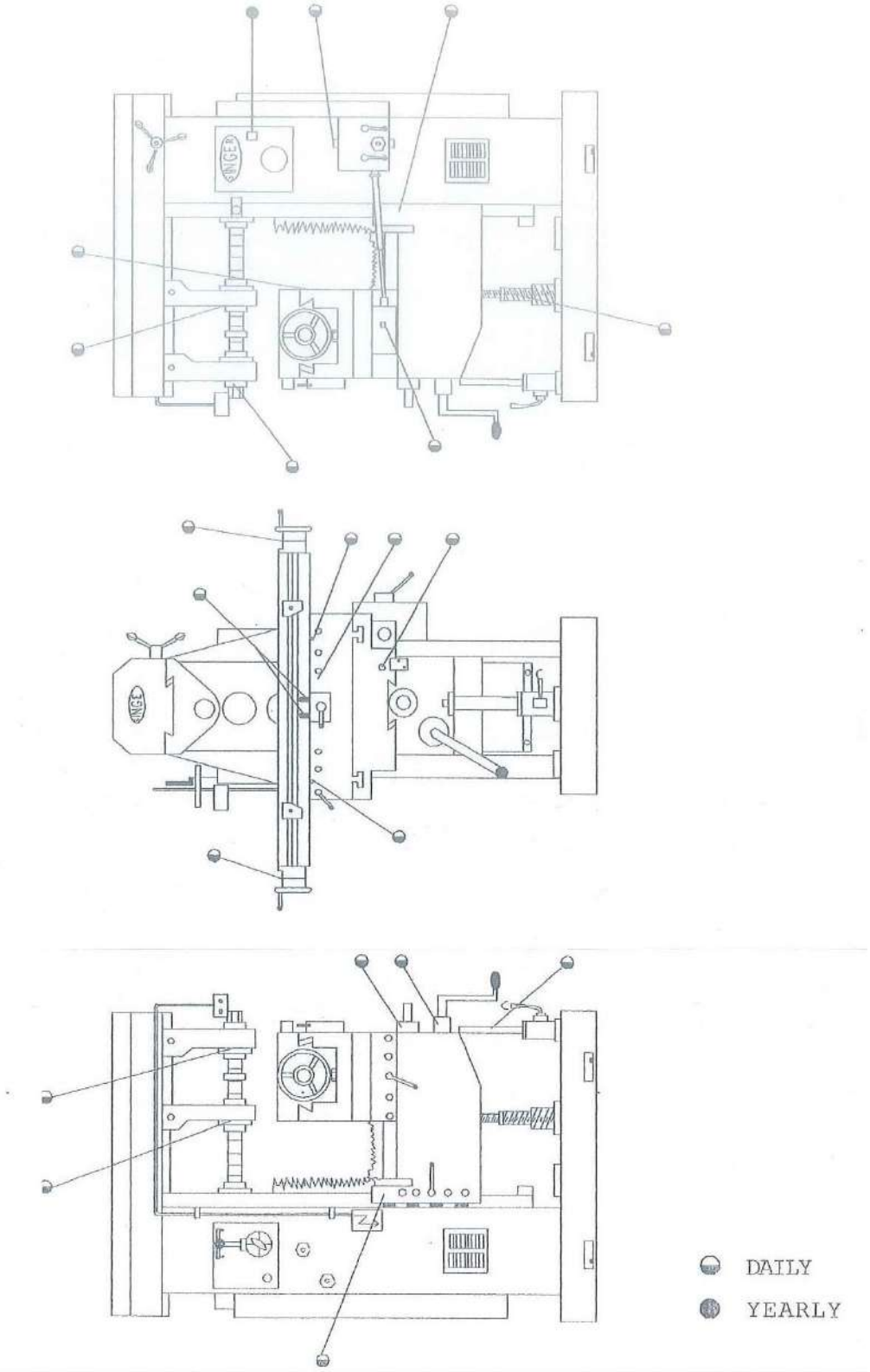


Fig. : 5- SCHEMATIC DIAGRAM OF MAIN DRIVE

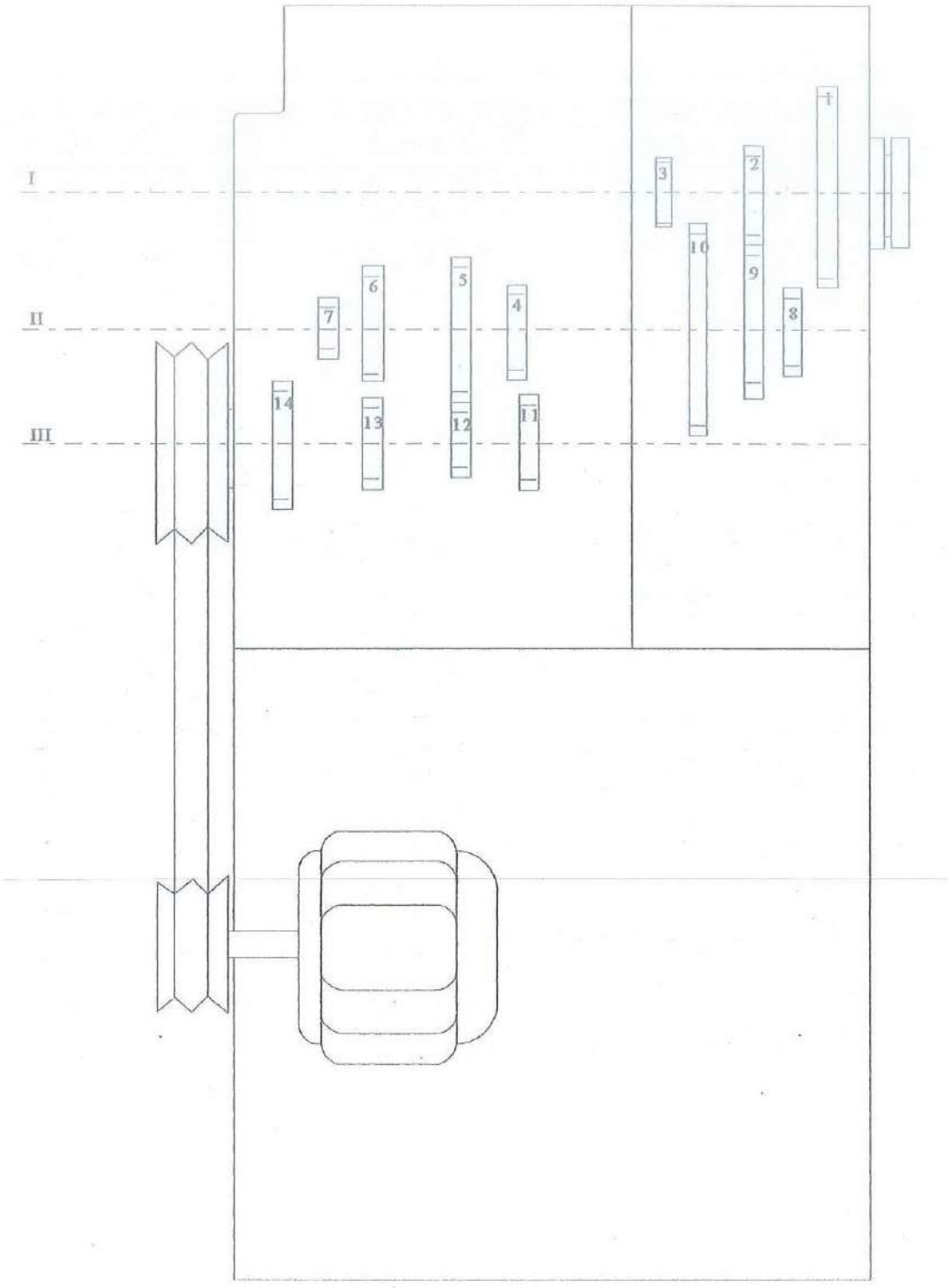


Fig. : 6- SCHEMATIC DIAGRAM OF FEED BOX

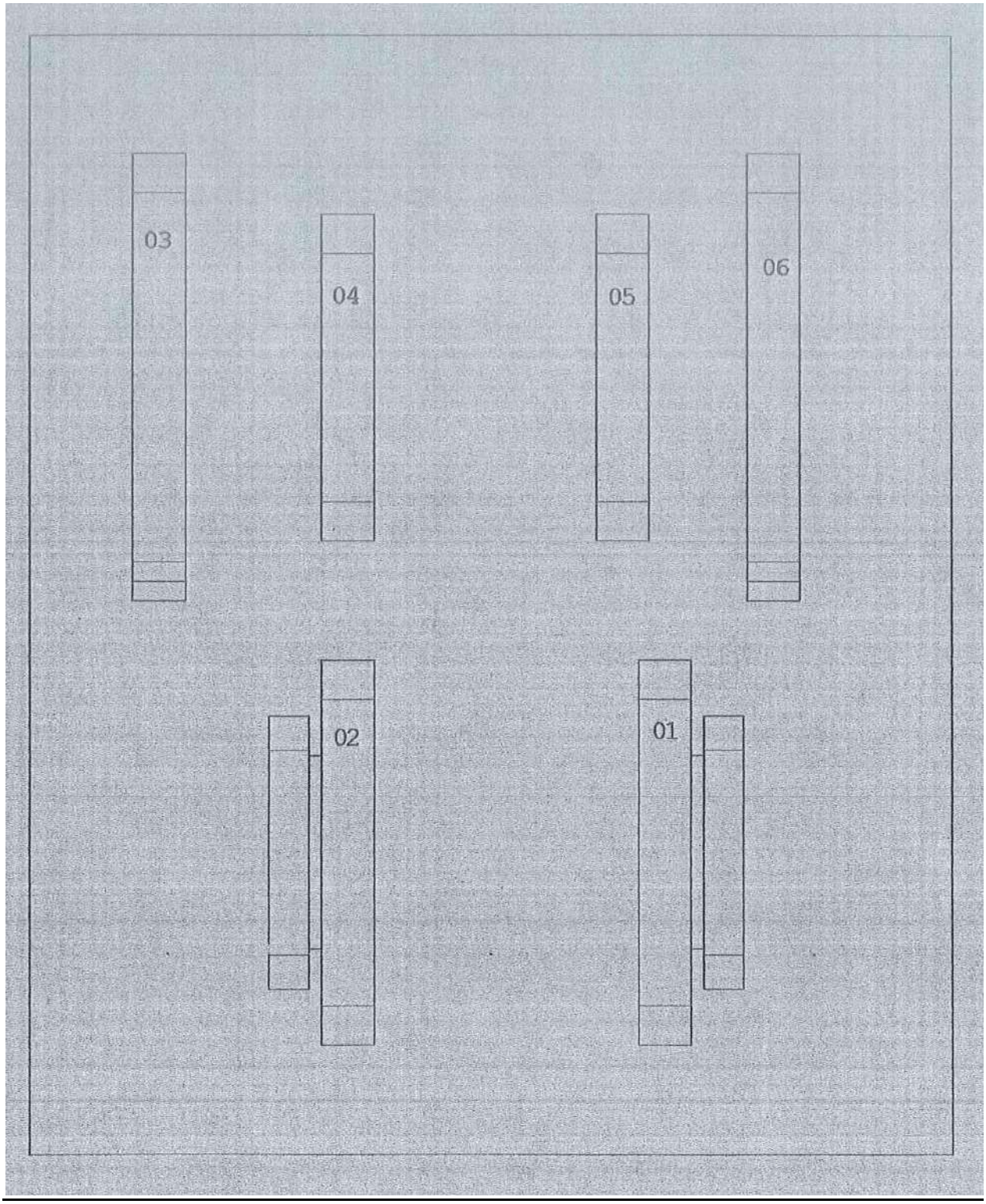
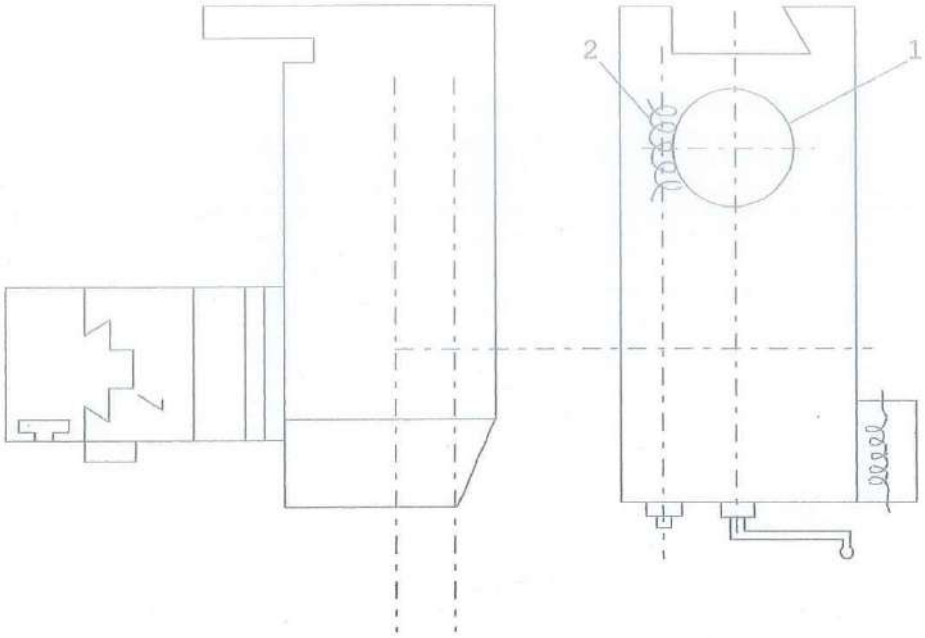


Fig. : 7- SCHEMATIC DIAGRAM OF KNEE



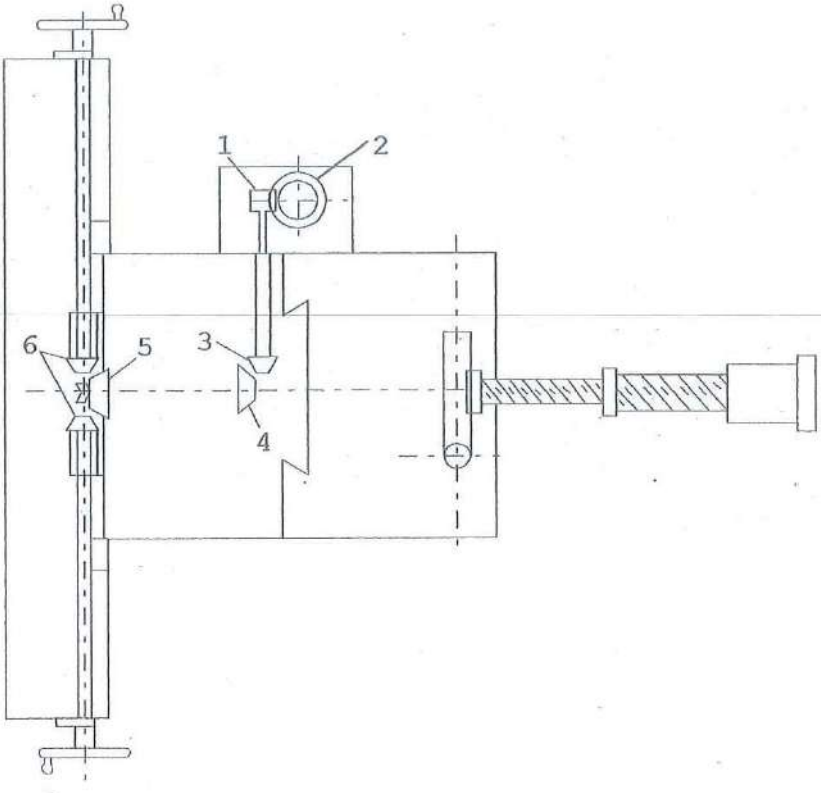


Fig. : 8- WORKING TABLE

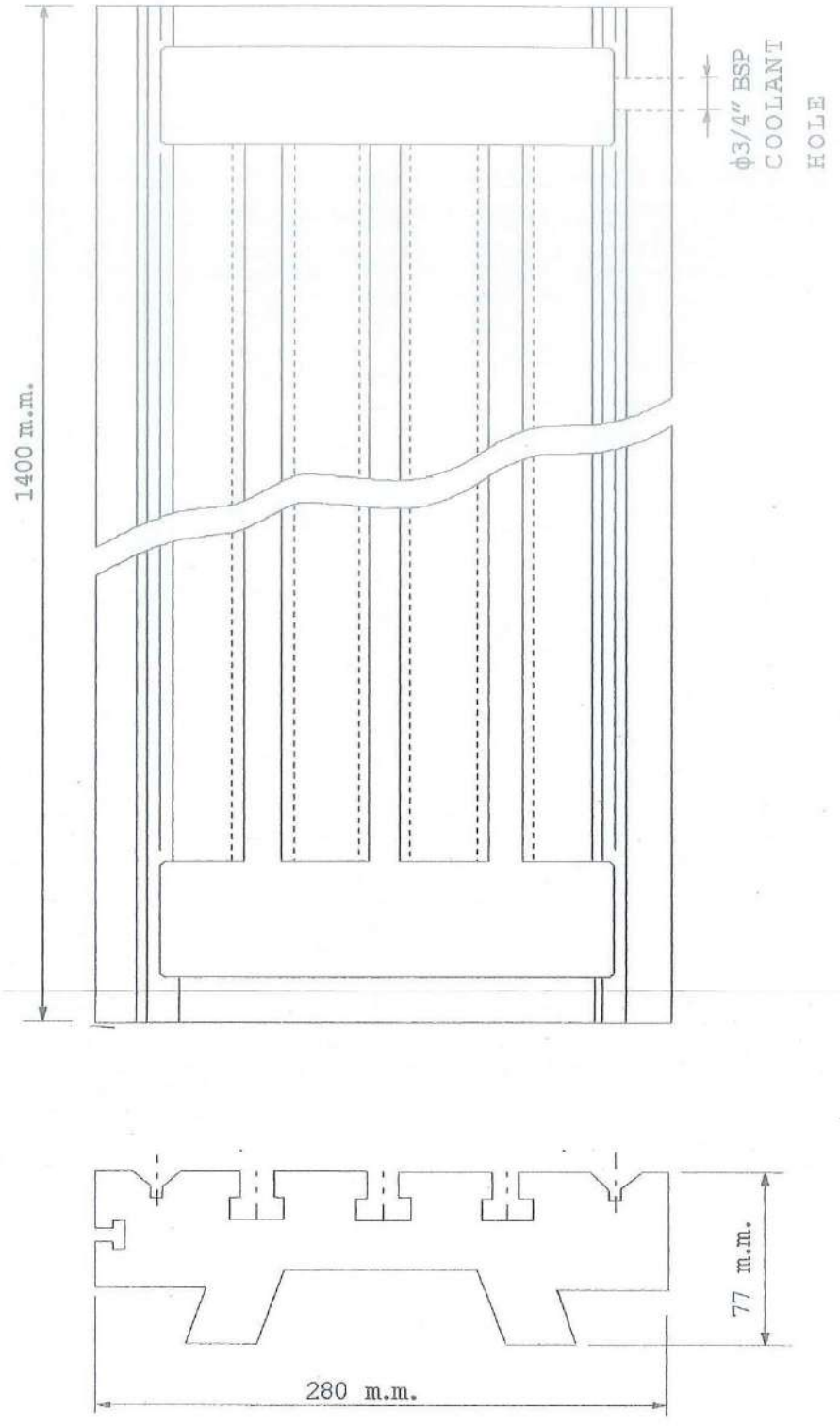
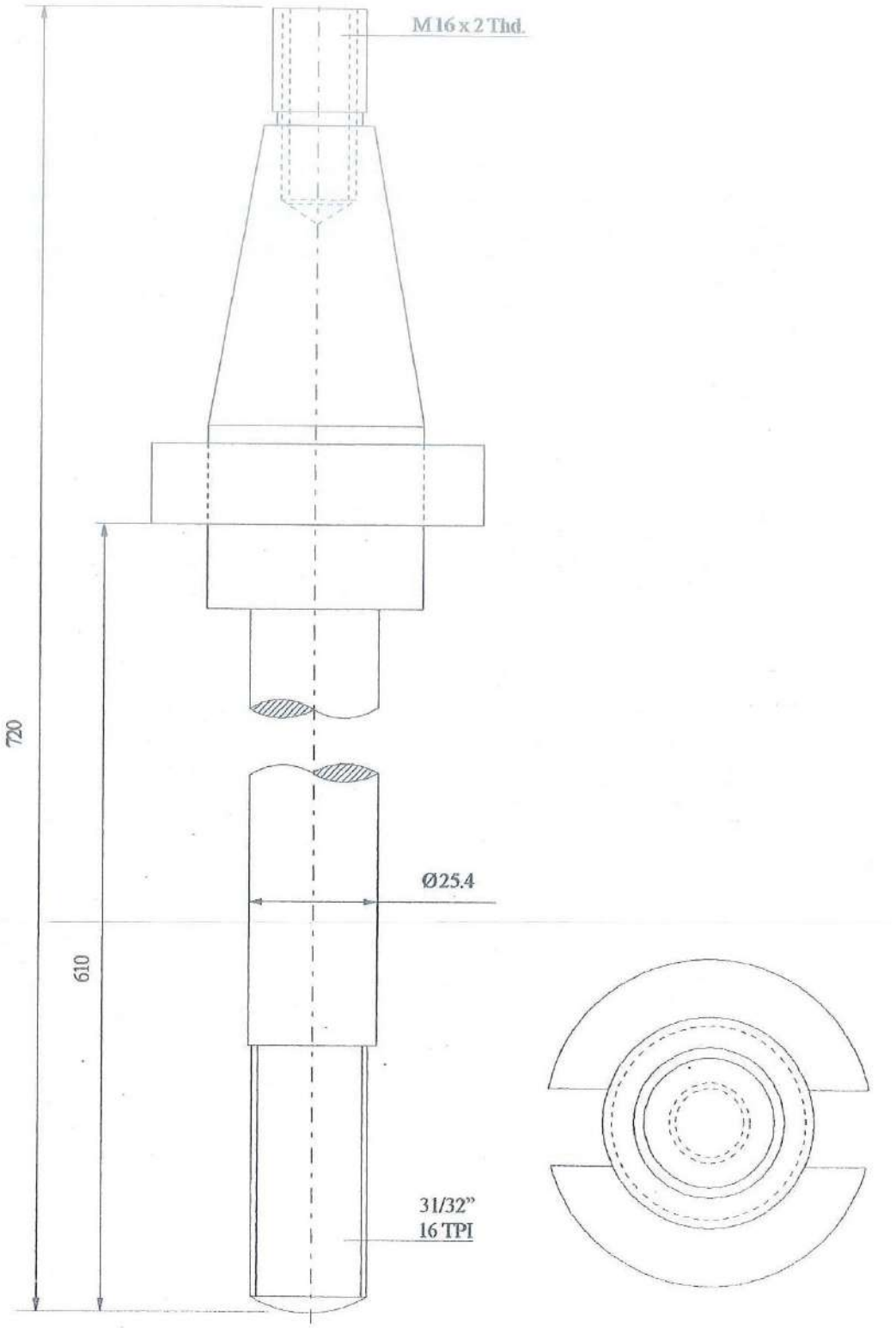


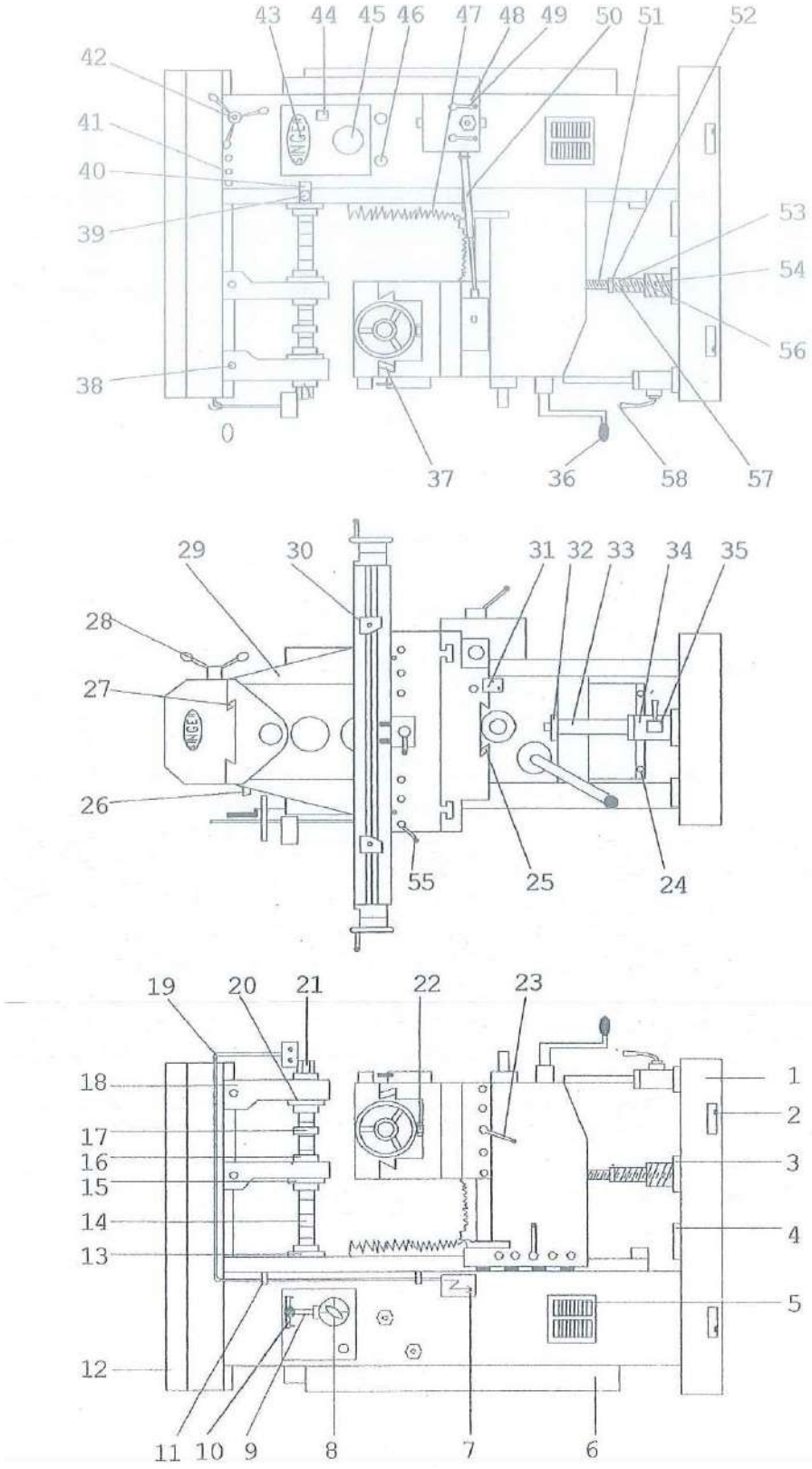
Fig. : 9- ISO-40 SPINDLE ARBOUR



GENERAL VIEW OF MILLING MACHINE (N-01 to N-57)

01.	BASE CASTING	C.I.	G- 01
02.	MACHINE LEVELLING BOLTS	M.S.	G- 02
03.	COOLANT TANK COVER (INVISIBLE)	M.S.SHEET	G- 03
04.	COOLANT FLANGE COVER	C.I.	G- 04
05.	BOTTOM SIDE COVER	C.I.	G- 05
06.	BELT GUARD	M.S. SHEET	G- 06
07.	ELECTRIC PANEL BOARD	M.S. SHEET	G- 07
08.	GEAR CHANGE LEVER ARROW	M.S.	G- 08
09.	GEAR CHANGE LEVER HANDLE	M.S.	G- 09
10.	GEAR CHANGE LEVER PLATE	C.I.	G- 10
11.	ELECTRIC PIPE CLAMP	M.S.	G- 11
12.	OVER ARM	C.I.	G- 12
13.	SPINDLE ARBOUR	EN-8	G- 13
14.	SPINDLE ARBOUR BUSH	EN-8	G- 14
15.	SUPPORTER BUSH	M.S.	G- 15
16.	SUPPORTER BUSH CHECK NUT	M.S.	G- 16
17.	CUTTER SUPPORT BUSH	EN-8	G- 17
18.	OVER ARM SUPPORT	C.I.	G- 18
19.	ELECTRIC PIPE	M.S. PIPE	G- 19
20.	SUPPORTER BEARING COVER	C.I.	G- 20
21.	ARBOUR NUT	M.S.	G- 21
22.	TABLE ANGULAR MOVEMENT LOCK NUT	M.S.	G- 22
23.	TABLE LOCK HANDLE	M.S.	G- 23
24.	TABLE VERTICAL TRAVEL LOCK BRACKET	M.S.	G- 24
25.	CROSS SLIDE WEDGE	M.S.	G- 25
26.	ELECTRIC PIPE CLAMP	C.I.	G- 26
27.	OVER ARM WEDGE	M.S.	G- 27
28.	OVER ARM MOVE BOSS	M.S.	G- 28
29.	CHAIN COVER	M.S. SHEET	G- 29
30.	TABLE LIMIT STOPPER	C.I.	G- 30
31.	CROSS SLIDE LOCK BRACKET	C.I.	G- 31
32.	JACK SUPPORT (T)	C.I.	G- 32
33.	JACK SUPPORT SHAFT	M.S.	G- 33
34.	JACK SUPPORT	C.I.	G- 34
35.	JACK SUPPORT HANDLE	C.I.	G- 35
36.	GENERAL HANDLE	M.S.	G- 36
37.	LONG SLIDE WEDGE	M.S.	G- 37
38.	SUPPORTER LOCK ROD	M.S.	G- 38
39.	SPINDLE LOCK	M.S.	G- 39
40.	SPINDLE LOCK BRACKET	C.I.	G- 40
41.	OVER ARM WEDGE SETTING BOLT	M.S.	G- 41
42.	OVER ARM LOCK HANDLE	M.S.	G- 42
43.	SINGER NAME PLATE WINDOW	C.I.	G- 43
44.	OIL FILTER CUP	M.S.	G- 44
45.	ACRYLIC GLASS	ACRYLIC	G- 45
46.	OIL DRAW PLUG	M.S.	G- 46
47.	SAFETY GUARD	M.S. SHEET	G- 47
48.	FEED BOX COVER	C.I.	G- 48
49.	FEED LEVER	M.S.	G- 49
50.	UNIVERSAL JOINT SET	M.S.	G- 50
51.	TELESCOPIC INNER SCREW	M.S.	G- 51
52.	TELESCOPIC INNER SCREW NUT	P.B.	G- 52
53.	TELESCOPIC OUTER SCREW	M.S.	G- 53
54.	TELESCOPIC OUTER SCREW NUT	C.I.	G- 54
55.	TABLE LOCK HANDLE	M.S.	G- 55
56.	OUTER SCREW CHECK NUT	M.S.	G- 56
57.	INNER SCREW CHECK NUT	M.S.	G- 57

Fig. : 3- GENERAL VIEW OF MILLING MACHINE (N-01 to N-57)

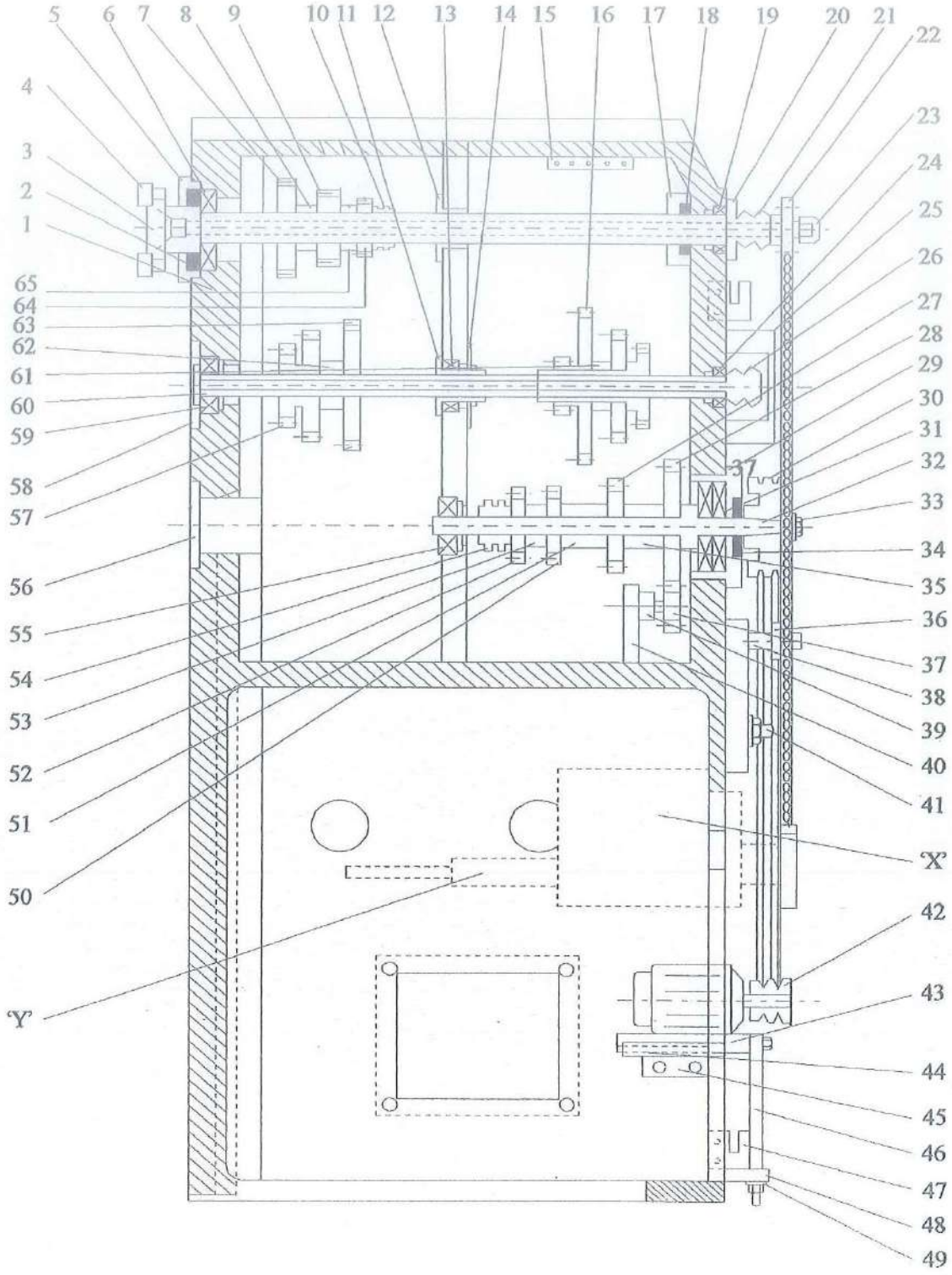


MAIN DRIVE GEAR BOX (M-01 to M-65)

01.	Main body	CI.	M - 01
02.	Main spindle front oil seal	Rubber	M - 02
03.	Main spindle	EN-8	M - 03
04.	Main spindle nose dog	M.S.	M -- 04
05.	Main spindle front oil seal cover	C.I.	M - 05
06.	Main spindle front bearing (32214)	Brg. steel	M - 06
07.	Main spindle gear A-80T	20MnCr 5	M -- 07
08.	Main spindle gear distance piece	C.I.	M - 08
09.	Main spindle gear B-56T	20MnCr5	M - 09
10.	Main spindle gear check nut/lock	M.S.	M - 10
11.	Intermediate shaft spine bush	M.S.	M - 11
12.	Main spindle Intermediate bush	G.M.	M - 12
13.	Intermediate bearing (6209)	Brg. steel	M - 13
14.	Spindle bush cover & circlip	M. S. & A-45	M - 14
15.	Oil distribution bracket	M.S.	M - 15
16.	Sliding gear B 51T/63T/59T/47T	20MnCr5	M - 16
17.	Main spindle rear oil seal cover	C.I.	M - 17
18.	Main spindle rear oil seal	Rubber	M - 18
19.	Main spindle rear brg. (32211)	Brg. steel	M - 19
20.	Main spindle rear brg. cover	C.I.	M - 20
21.	Main spindle rear brg. check nut	M.S.	M - 21
22.	Main spindle chain gear 20T	M.S.	M - 22
23.	Arbor tie rod, washer & nut	M.S.	M - 23
24.	Intermediate shaft rear brg. (30306)	Brg. steel	M - 24
25.	Intermediate shaft rear brg. cover	C.I.	M - 25
26.	Intermediate shaft rear brg. check nut	M.S.	M - 26
27.	Driving shaft gear C-30T	20MnCr5	M - 27
28.	Driving shaft gear D-42T	20MnCr 5	M - 28
29.	Driving shaft rear brg. cup	C.I.	M - 29
30.	Driving pulley	C.I.	M - 30
31.	Driving shaft rear brg. (6306)	Brg. steel	M - 31
32.	Driving shaft	EN-8	M - 32
33.	Pulley clamping washer& nut	M. S..	M - 33
34.	Driving shaft rear oil seal	Rubber	M - 34
35.	Driving shaft distance piece-c	M.S.	M - 35
36.	Chain tighter gear - 20T	M. S .	M - 36
37.	Oil pump gear - 33T	M.S.	M - 37

38.	Chain tighter pin, washer & nut	M. S .	M - 38
39.	Oil pump	M.S.	M - 39
40.	Chain cover	M.S.Sheet	M - 40
41.	Chain tighter bkt, stud & nut	M.S.	M - 41
42.	Motor pulley	C.I.	M - 42
43.	Motor pulley	C.I.	M - 43
44.	Motor plate rod	M.S.	M - 44
45.	Motor plate hinges	C.I.	M - 45
46.	Belt tighter rod	M.S.	M - 46
47.	Belt guard hinges	M. S .	M - 47
48.	Belt tighter bkt.	C.I.	M - 48
49.	Belt tighter washer & nut	M. S .	M - 49
50.	Driving shaft gear B - 34T	20MnCr 5	M -- 50
51.	Driving shaft distance piece-B	M. S .	M - 51
52.	Driving shaft gear A – 46T	20MnCr 5	M - 52
53.	Driving shaft distance piece-A	M. S.	M - 53
54.	Driving shaft gear check nut	M. S .	M - 54
55.	Driving shaft front brg. 6206	Brg. Steel	M - 55
56.	Driving shaft front Cover	M. S.	M - 56
57.	Sliding gear A-26T/50T	20MnCr5	M - 57
58.	Intermediate shaft front brg. cover	M. S .	M - 58
59.	Intermediate shaft front brg. 30309	Brg. Steel	M - 59
60.	Intermediate shaft	En-8	M - 60
61.	Distance piece	M.S.	M - 61
62.	Distance piece	M. S	M - 62
63.	Intermediate shaft gear - 74 T	20MnC r 5	M - 63
64.	Distance piece	M.S.	M - 64
65.	Main spindle gear - 32 T	20Mn.Cr 5	M - 65

MAIN DRIVE GEAR BOX (M-01 to M-65)



FEED BOX ASSEMBLY (F-01 to F-51)

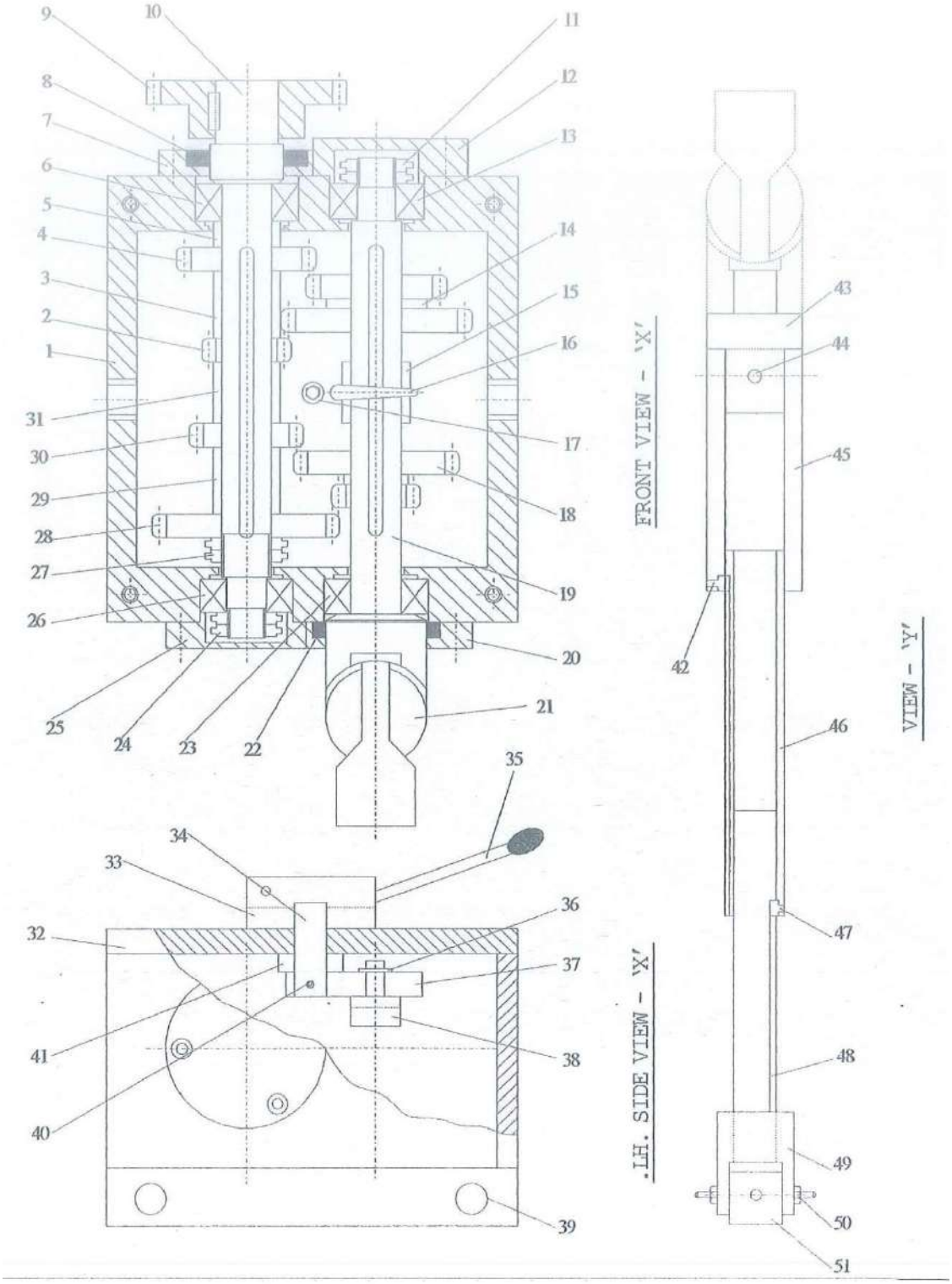
VIEW – 'X'

01.	Feed gear box	C.I.	F - 01
02.	Spur gear C-16 T	20MnCr5	F - 02
03.	Distance piece	M.S.	F - 03
04.	Spur gear D-26 T	20MnCr5	F - 04
05.	Distance Piece - 2	M.S.	F - 05
06.	Bearing - 30204	Brg. Steel	F - 06
07.	Chain gear shaft oil seal cover (Rear)	C.I.	F - 07
08.	Chain gear 30T	M.S.	F - 08
09.	Chain gear oil seal	Rubber	F - 09
10.	Chain gear shaft (upper)	En-8	F - 10
11.	Joint end shaft check nut	M.S.	F - 11
12.	Joint end shaft cover (rear)	C.I.	F - 12
13.	Bearing - 30204	Brg. Steel	F- 13
14.	Joint gear N - 36T/26T	20MnCr5	F - 14
15.	Distance piece	M.S.	F - 15
16.	Tapper pin	M.S.	F - 16
17.	Feed box mounting alien bolt	En-8	F - 17
18.	Feed gear M - 20T/31T	20MnCr5	F - 18
19.	Joint end shaft	En-8	F - 19
20.	Joint end shaft oil seal cover (front)	C.I.	F - 20
21.	Universal joint end	En-8	F - 21
22.	Joint end oil seal	Rubber	F - 22
23.	Bearing 30205	Brg. Steel	F - 23
24.	Chain gear shaft check nut	M.S.	F - 24
25.	Chain gear shaft front cover	C.I.	F -25
26.	Bearing 30204	Brg. Steel	F - 26
27.	Spur gear check nut	M.S.	F - 27
28.	Spur gear A - 45T	20MnCr5	F -28
29.	Distance piece - W	M.S.	F - 29
30.	Spare gear B - 21T	20MnCr5	F - 30
31.	Distance piece – X	M.S.	F - 31
32.	Feed gear box cover	C.I.	F - 32
33.	Feed change lever boss	C.I.	F.- 33
34.	Feed change lever pin	C.I.	F - 34
35.	Feed change lever handle	M.S.	F - 35
36.	CircLip	A - 16	F - 36
37.	Feed lever patti	M.S.	F - 37
38.	'C' Bracket	M.S.	F - 38
39.	Feed box mounting bolts (holes)	M.S.	F - 39
40.	Taper pin	M.S.	F - 40
41.	Support boss	C.I.	F - 41

VIEW – 'Y'

42.	Stepped key	M.S.	F - 42
43.	Joint end boss	M.S.	F - 43
44.	Taper pin	M.S.	F - 44
45.	Main body	M.S.	F - 45
46.	Intermediate body	M.S.	F - 46
47.	Stepped key	M.S.	F - 47
48.	Internal body (Rod)	M.S.	F - 48
49.	Worm end kan	M.S.	F - 49
50.	Allen bolts / Hex nut	En-8/M.S.	F - 50
51.	Square key	M.S.	F - 51

FEED BOX ASSEMBLY (F-01 to F-51)



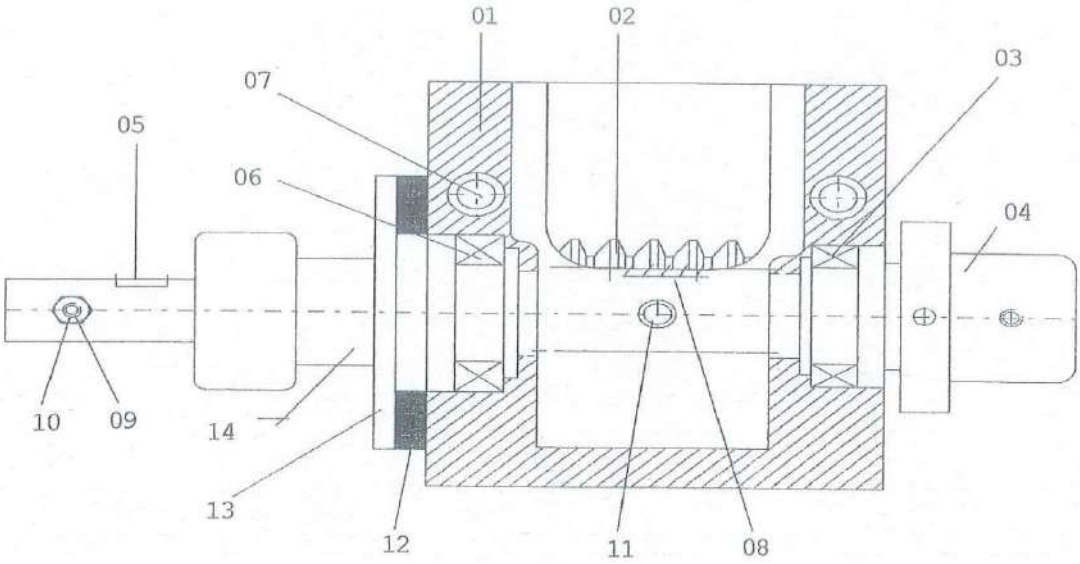
WORM BOX ASSEMBLY

WBA- 01 to WBA- 14

01.	Worm box	C.I.	WBA - 01
02.	Single start worm	En-8	WBA - 02
03.	Brg. – 30204	Brg. steel	WBA - 03
04.	Shaft nut	C.I.	WBA - 04
05.	Key	M. S .	WBA - 05
06.	Brg. 30205	Brg. steel	WBA - 06
07.	Allen bolts	En-31	WBA - 07
08.	Key	M. S.	WBA - 08
09.	Allen grub & hex nut joint	En-31 & M. S.	WBA - 09
10.	Pin	M.S.	WBA - 10
11.	Oil cup	Steel	WBA - 11
12.	Oil seal	Rubber	WBA - 12
13.	Oil seal cover	C.I.	WBA -. 13
14.	Worm shaft	En-8	WBA - 14

WORM BOX ASSEMBLY

WBA- 01 to WBA- 14



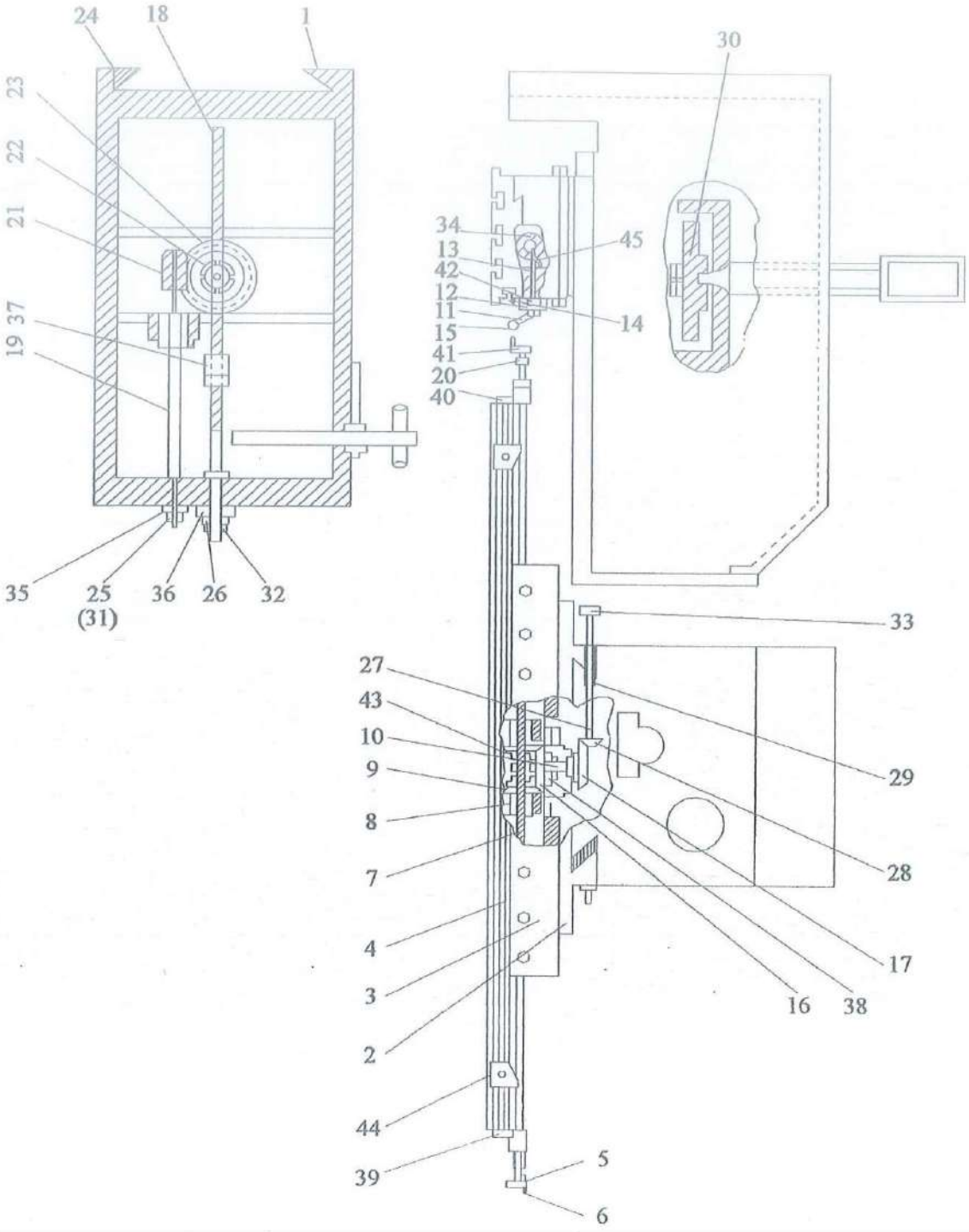
KNEE ASSEMBLY

K- 01 to K- 45

01.	Knee casting	C.I.	K – 01
02.	Knee saddle	C.I.	K – 02
03.	Table saddle	C.I.	K – 03
04.	Table	C.I.	K – 04
05.	Table handle wheel big	C.I.	K – 05
06.	Wheel handle	M.S.	K – 06
07.	Table screw	M.S.	K – 07
08.	Reversing bevel block	C.I.	K – 08
09.	Bevel 29T	20MnCr5	K – 09
10.	Lead screw	En-8	K – 10
11.	Lever handle	M.S.	K – 11
12.	Limit box	M.S.	K – 12
13.	Lever pin	M.S.	K – 13
14.	Safety press pins	M.S.	K – 14
15.	Knob	Bakelite	K – 15
16.	Upper bevel 29T	20MnCr5	K – 16
17.	Lower bevel 29T	20MnCr5	K – 17
18.	Shaft no.1	En-8	K – 18
19.	Shaft no.2	En-8	K – 19
20.	Dial ring	PB-2	K – 20
21.	Worm wheel 4 start	En-8	K – 21
22.	Worm check nut	M.S.	K – 22
23.	Worm gear 30Teeth	PB-2	K – 23
24.	Knee vertical bearing piece	C.I.	K – 24
25.	Table bearing piece	C.I.	K – 25
26.	Knee saddle bearing piece	C.I.	K – 26
27.	Worm gear shaft no. 3	En-8	K – 27
28.	Bevel gear 20T	20MnCr5	K – 28
29.	Bush (Worm shaft bush)	C.I.	K – 29
30.	Eccentric boss	M.S.	K – 30
31.	Dial ring boss	C.I.	K – 31
32.	Handle bush	M.S.	K – 32
33.	21T Worm gear	PB-2	K – 33
34.	Lead screw nut	PB- 2	K – 34
35.	Vertical move shaft boss	C.I.	K – 35
36.	Cross slide shaft boss	C.I.	K – 36
37.	Cross slide nut	C.I.	K – 37
38.	Bevel gear flange	C.I.	K – 38
39.	Lead screw bracket (Small)	C.I.	K – 39
40.	Lead screw (Big)	C.I.	K – 40
41.	Wheel small	C.I.	K – 41
42.	Limit box star	M.S.	K – 42
43.	Grease cover	Aluminum	K – 43
44.	Limit stopper	C.I.	K – 44
45.	Dingily	C.I.	K – 45

KNEE ASSEMBLY

K- 01 to K- 45



GEAR CHANGE ASSEMBLY

GCA- 01 to GCA- 25

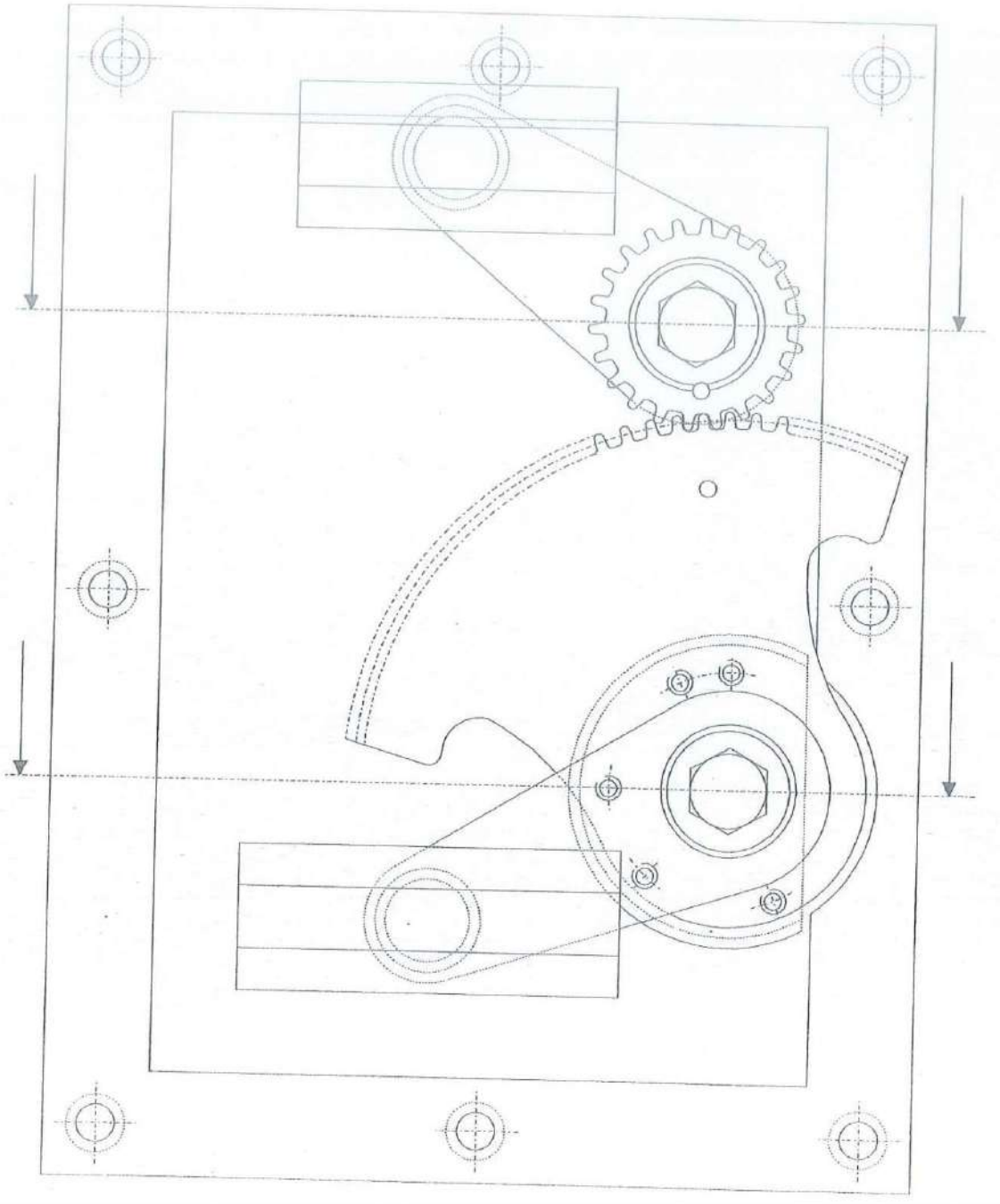
SECTION – "X-X"

01.	Gear change cover plate	C.I.	GCA - 01
02.	'C' Bracket 'A'	M.S.	GCA - 02
03.	'C' Bracket mounting pin	M.S.	GCA - 03
04.	Pin - M	M.S .	GCA - 04
05.	Boss - X	C.I.	GCA - 05
06.	Allen bolts	En-31	GCA - 06
07.	Patti – O	M. S .	GCA - 07
08.	Washer & bolt	M. S .	GCA - 08
09.	Key	M. S .	GCA -09
10.	Gear 30T	M. S .	GCA - 10
11.	Lever arrow pin	M. S .	GCA - 11
12.	Shaft - E	M. S .	GCA - 12
13.	Lever arrow	M. S .	GCA - 13
14.	Lever dial	Aluminum	GCA - 14
15.	Boss - Y	M.S.	GCA - 15
16.	Setting ball spring & bolt	spring steel	GCA - 16
17.	Square handle	M. S .	GCA - 17
18.	Knob	Bakelite	GCA - 18

SECTION – "Y-Y"

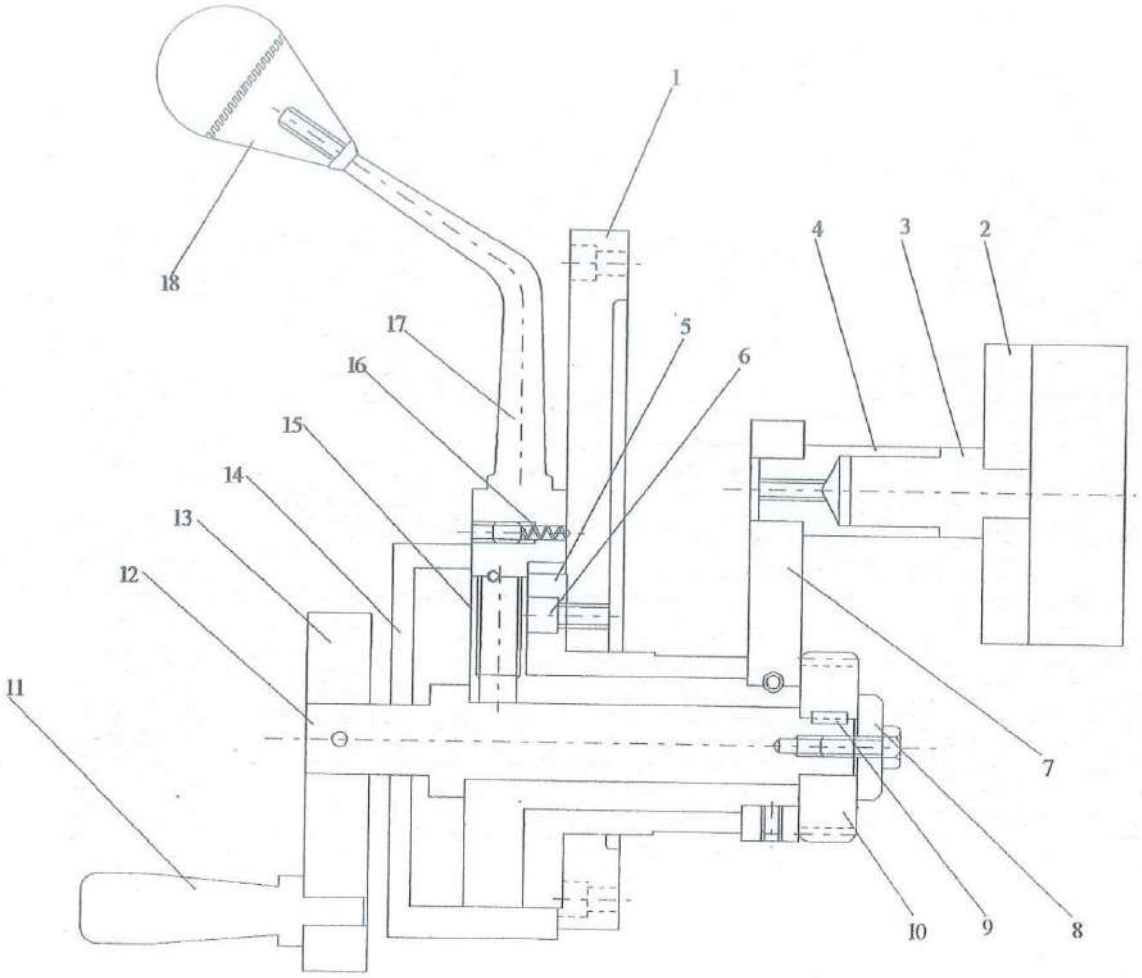
19.	Boss – Z	C.I.	GCA – 19
20.	Panji gear 31T	C.I.	GCA – 20
21.	Pin - N	M.S.	GCA – 21
22.	'C' Bracket - B	M.S.	GCA – 22
23.	Patti -P	M.S.	GCA – 23
24.	Washer & bolt	M.S.	GCA – 24
25.	Small shaft - F	M.S.	GCA - 25

GEAR CHANGE ASSEMBLY



GEAR CHANGE ASSEMBLY

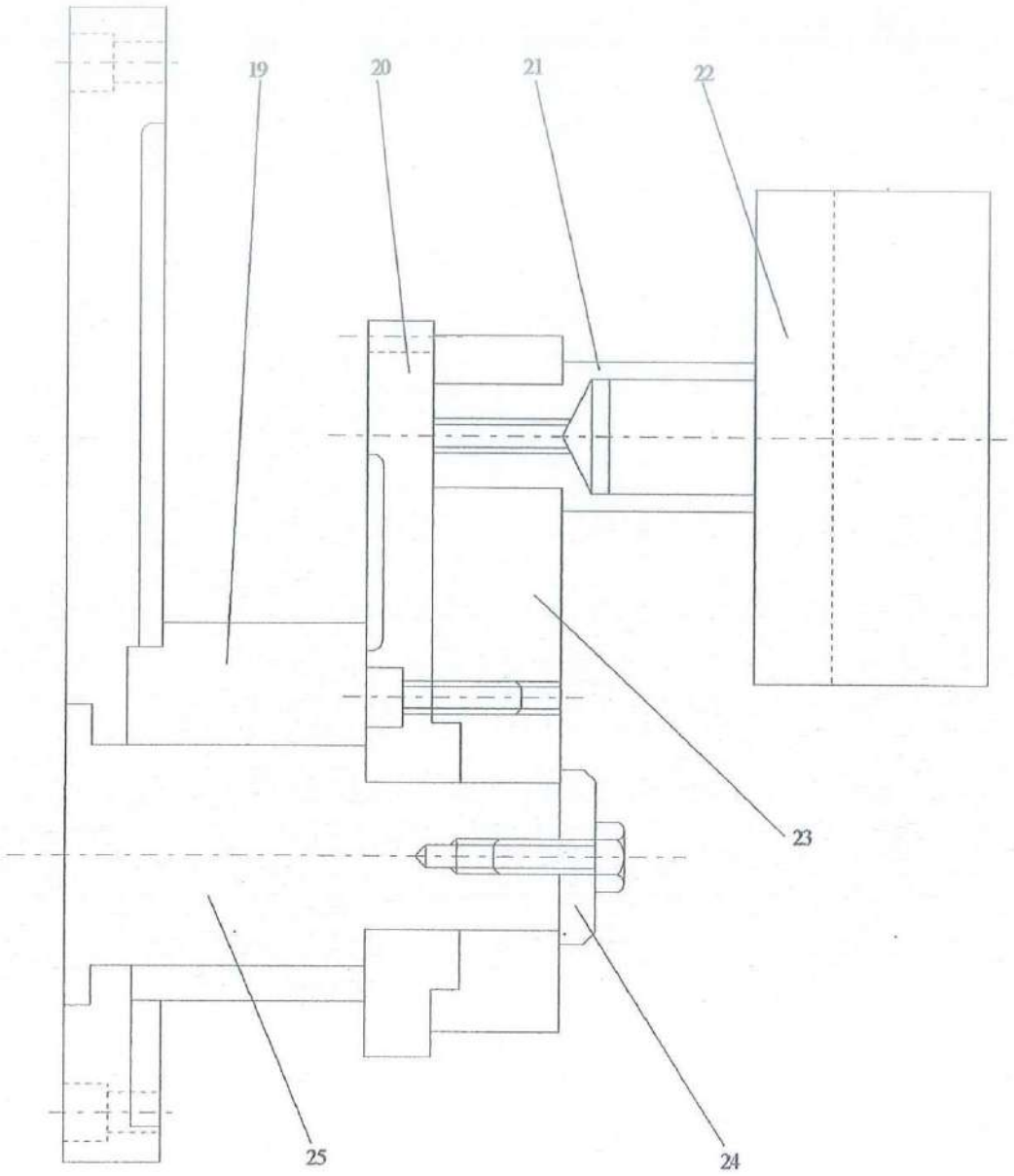
GCA- 01 to GCA- 18



SECTION - 'X-X'

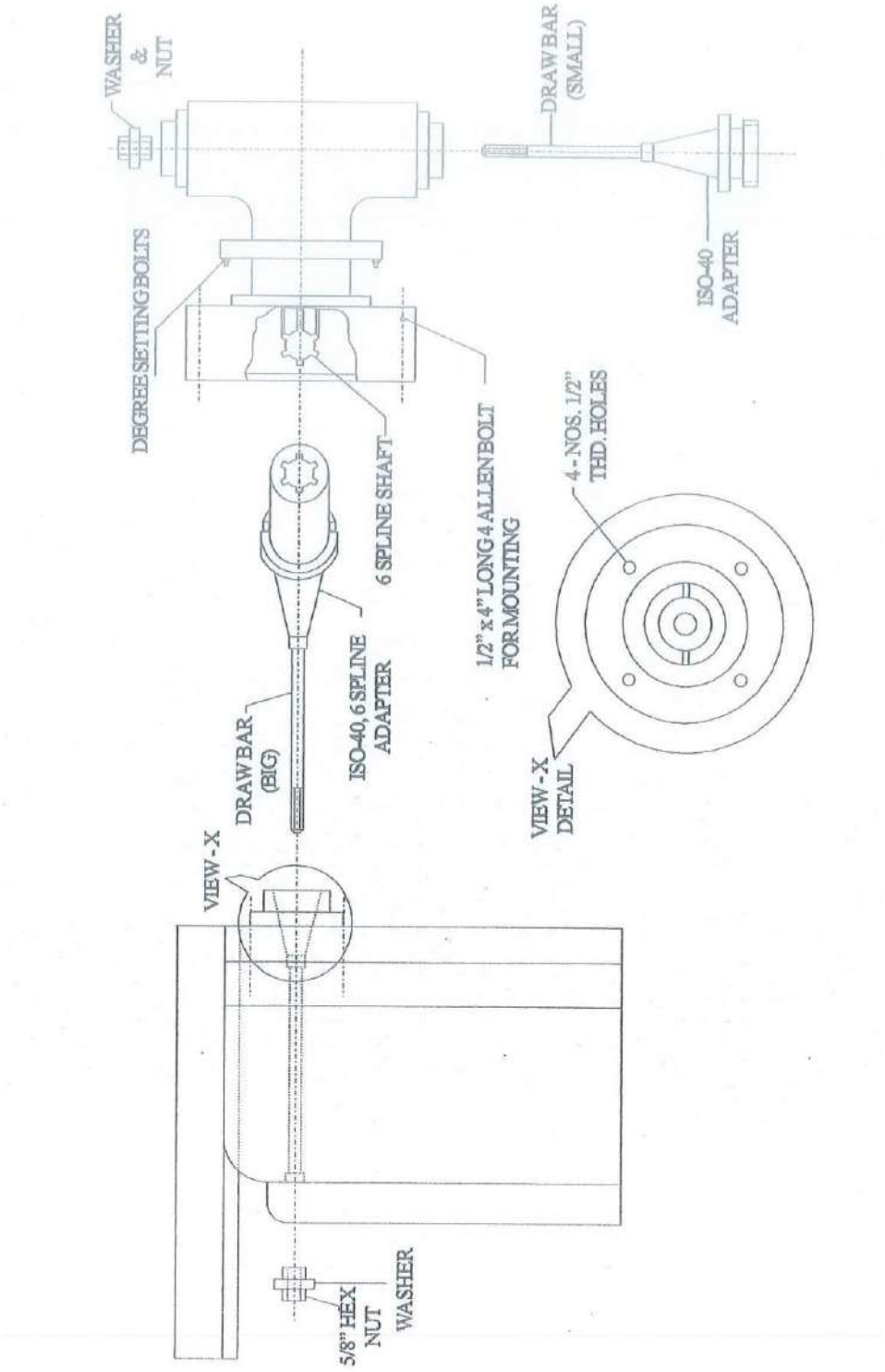
GEAR CHANGE ASSEMBLY

GCA- 19 to GCA- 25



SECTION -'Y-Y'

FIG.9- VIEW OF VERTICAL HEAD MOUNTING



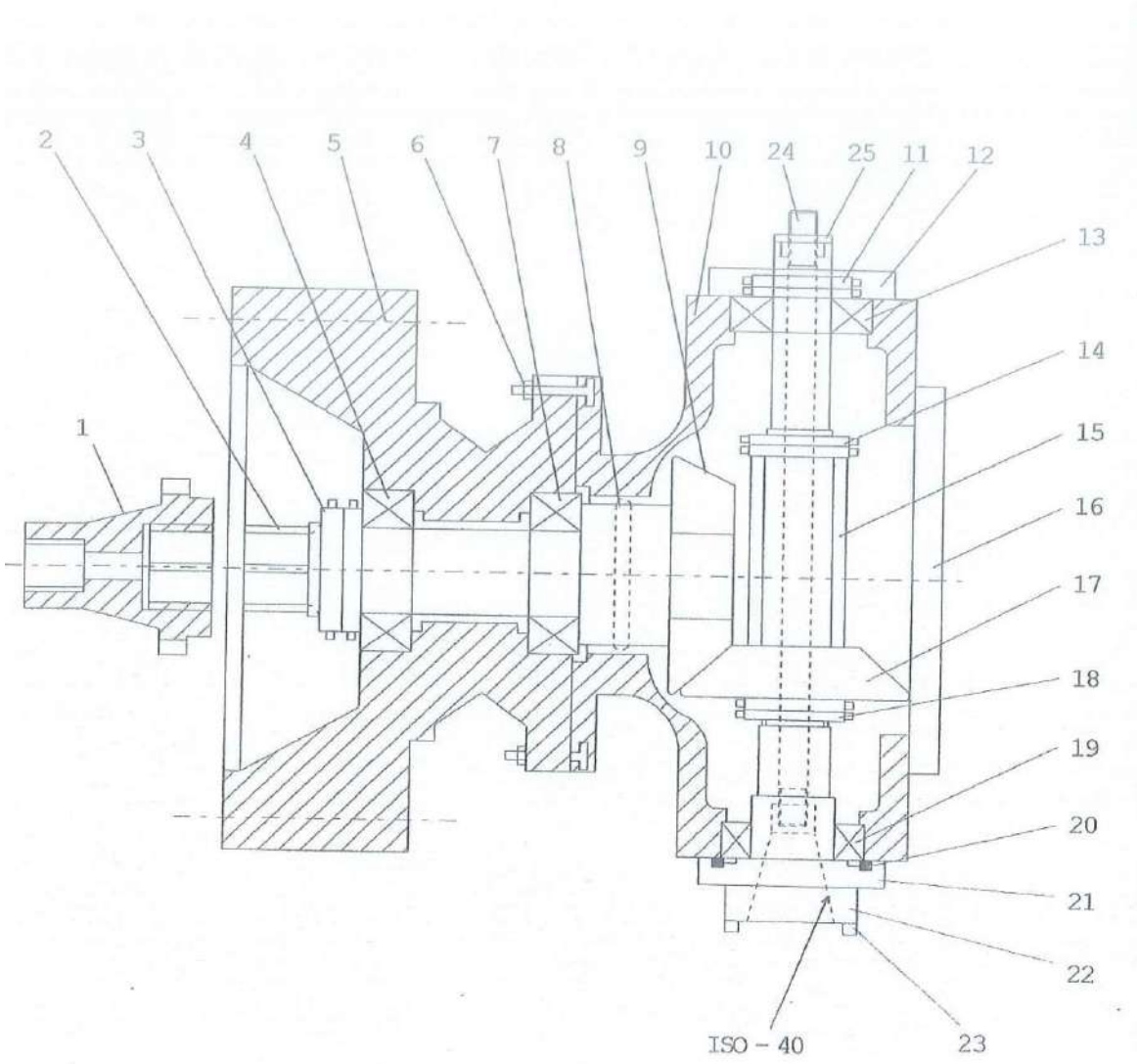
VERTICAL ATTACHMENT HEAD ASSEMBLY

VAH- 1 to VAH- 25

1.	ISO-40 6 spine socket	En-8	VAH - 01
2.	6 Spine shaft	En-8	VAH - 02
3.	Spleen shaft check nut	M.S.	VAH - 03
4.	Bearing – 30206	Brg. Steel	VAH - 04
5.	Head mounting base	C.I.	VAH - 05
6.	T Bolt & Nut	M.S.	VAH - 06
7.	Bearing – 30206	Brg. Steel	VAH - 07
8.	Taper pin	M.S.	VAH - 08
9.	Spiral bevel pinion gear - 24T	SAE-8620	VAH - 09
10.	Vertical head body	C.I.	VAH - 10
11.	Spindle rear brg. check nut	M.S.	VAH - 11
12.	Spindle rear cover	C.I.	VAH - 12
13.	Bearing – 30207	Brg. Steel	VAH - 13
14.	Spiral bevel upper setting check nuts	M.S.	VAH - 14
15.	Distance piece	M.S.	VAH - 15
16.	Grease cover	Al.	VAH - 16
17.	Spiral bevel gear - 24T	SAE-8620	VAH - 17
18.	Spiral bevel lower setting check nuts	M.S.	VAH - 18
19.	Bearing – 30210	Brg. Steel	VAH - 19
20.	Spindle lower oil seal	Rubber	VAH - 20
21.	Spindle lower brg. cover	C.I.	VAH - 21
22.	Spindle	En-8	VAH - 22
23.	Spindle nose dog	M. S.	VAH - 23
24.	Tie rod	M. S.	VAH - 24
25.	Tie rod waher	M .S.	VAH - 25

VERTICAL ATTACHMENT HEAD ASSEMBLY

VAH- 1 to VAH- 25



SPINDLE R.P.M.	LONG FEED		
		Mm/Rev.	Mm/min.
70	A	0.45	31.50
	B	0.14	9.80
	C	0.09	6.30
	D	0.20	14.00
90	A	0.45	40.50
	B	0.14	12.60
	C	0.09	8.10
	D	0.20	18.00
115	A	0.45	51.75
	B	0.14	16.10
	C	0.09	10.35
	D	0.20	23.00
145	A	0.45	65.25
	B	0.14	20.30
	C	0.09	13.05
	D	0.20	29.00
185	A	0.45	83.25
	B	0.14	25.90
	C	0.09	16.65
	D	0.20	37.00
235	A	0.45	105.75
	B	0.14	32.90
	C	0.09	21.15
	D	0.20	47.00
300	A	0.45	135.00
	B	0.14	42.00
	C	0.09	27.00
	D	0.20	60.00
380	A	0.45	171.00
	B	0.14	53.20
	C	0.09	34.20
	D	0.20	76.00
475	A	0.45	213.75
	B	0.14	66.50
	C	0.09	42.75
	D	0.20	95.00
600	A	0.45	270.00
	B	0.14	84.00
	C	0.09	54.00
	D	0.20	120.00
790	A	0.45	355.50
	B	0.14	110.60
	C	0.09	71.10
	D	0.20	158.00
1000	A	0.45	450.00
	B	0.14	140.00
	C	0.09	90.00
	D	0.20	200.00

BEARING LIST

(1) Bearing :

a) **Spindle baring – 32214, 32211 (SKF) One No. each.**
b) **Intermediate shaft bearing – 30309, 6209, 30306 (SKF) One. No. each.**
c) **Drive shaft bearing – 6206, 6306, 6306 (SKF).**
d) **Screw jack – 30206 & Thrust brg. 08 One No. each.**
e) **Idler chain gear : 6203 (1 no.)**
f) **Feed drive gear box :**
   1) Shaft no. 1 – 30204, 30205 (SKF)
   2) Shaft no. 2 – 30204, 30205 (SKF)

g) **Table Reversing :**
   1) Bevel gear 2 Pcs – 51108 (4 nos.)
   2) Table screw Thrust brg. 07 (2 nos.)
h) **Worm Box :** 30204, 30205 (SKF) One No. each.
i) **Bevel gear flange :** 30207, 30207 (SKF)
j) **Bevel gear shaft :** 30204 (SKF), 51104 Thrust brg. One No. each.
k) **Supporter bearing :** 30208 (2 nos.), 51108 (2 nos.)
l) **Cross slide screw bearing :** Thrust brg. 08 (1 no.)
m) **Vertical Attachment :** 30206 (2 Nos.)**,** 30207 (SKF)**,** 30210.

(2) Standard and Special equipments :

Standard : Spindle arbor, Instruction manual, Draw bolt, Handle, Setting Bolts.

Special : milling attachment, Machine swivel base vice, Universal dividing head, Special size milling arbor, Foundation bolt, Rack cutting attachment.

V-Belt : B-63

Test Chart For Milling Machine with Table of Variable height with Vertical Spindle

Sr. No.	Description	Measuring Instrument	Permissible	Actual
1.	Squarness & Straightness of the Vertical movement of the knee of the table surface.	Dial gauge & Square	0.02 mm Length of 300mm	
2.	Flatness of the table Surface.	Precision level or Straight edge and Slipe gauge	0.04 mm upto 1000 mm Length	
3.	Parallism of the table Surface of its movements.	(i) Longitudinally (ii) Transversely (Both-dial gauge)	0.02 mm upto 300 mm length	
4.	Run out of the spindle bore.	Dial gauge	0.015mm	
5.	True Running of the taper bore of the spindle.	Dial gauge	0.02 mm	
6.	Arbor Run out with Support.	Dial gauge	0.015 mm	
7.	Arbor Run out without Support.	Dial gauge	0.05 mm	
8.	Squarness of the spindle axis to the table surface.	Dial gauge (1) For Horizontal (2) For Vertical	0.015 mm 0.015 mm	
9.	Vertical Spindle bore Run out.	Dial gauge	0.015 mm	
10.	Squarness & Straightness of the cross movement of the knee to Arbor.	Dial gauge 200 mm Length	0.040 mm Max.	