ALEXANDER

MASTER TOOLMAKER

GEORGE H. ALEXANDER MACHINERY LTD.

MACHINERY · TOOLS · SUPPLIES

[illegible] COLLS HILL STREET · BIRMINGHAM
ENGLAND

TELEPHONE [illegible] · TELEGRAMS "VICE" BIRMINGHAM

LONDON · GLASGOW · MANCHESTER · NEWCASTLE · NEW YORK

Since printing this Instruction Book, some minor alterations have been made so that the illustrations and details in this book are in no way binding and are subject to alteration without notice.

Page 13

The reference to 45° is really meant to indicate that the table can be automatically traversed diagonally.

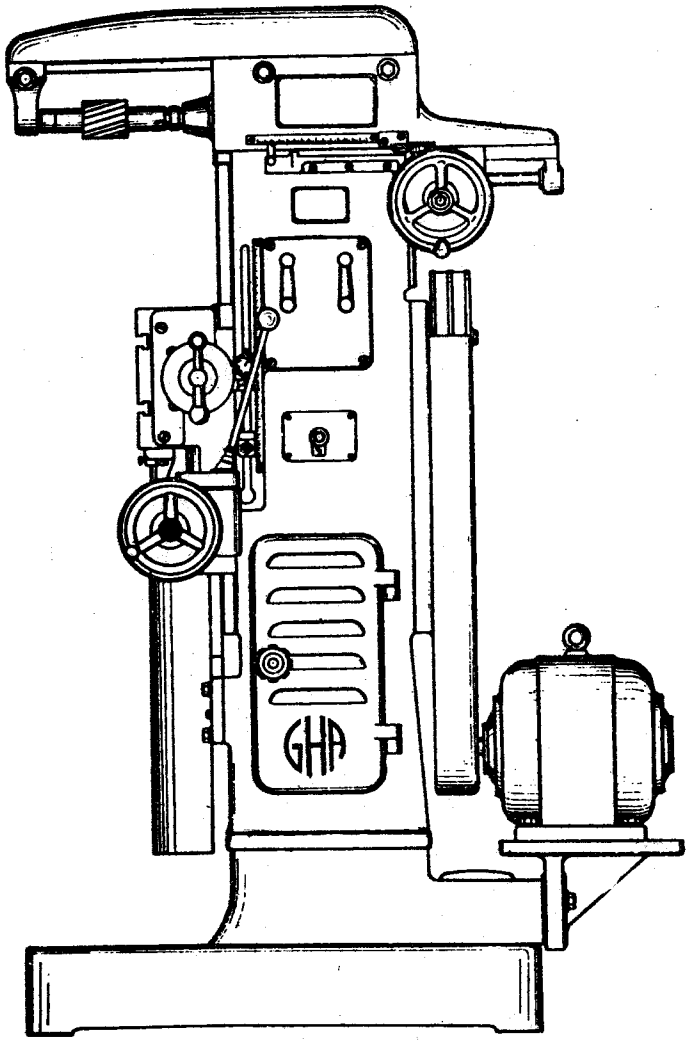
Page 19

An alteration to the construction of the head has been made since printing this Instruction Book, so that the spanner shown is no longer used, and is therefore, not part of the standard equipment.

ALEXANDER

MASTER TOOLMAKER

Standard Machine fitted with Cutter Arbor Support.



Individual Drive.
6 spindle speeds with standard constant speed motor.
12 „ „ „ two-speed pole changing motor.
Automatic table feeds with single lever selector.

THE STANDARD MACHINE

Horizontal spindle

Headstock adjustable in spindle direction up to $5\frac{7}{8}$"
Morse taper 4,
spindle adapted for standard spring collets up to $\frac{11}{16}$" bore,
cutter arbor support for cutters up to $5\frac{1}{8}$" dia.
arbor dia. 1" or $\frac{7}{8}$"

Drive

Individual drive by standard motor 2 H.P., 1200 rev. p. min. or by two-speed pole changing motor 600/1200 rev. p. min. transmission of power by 2 V-belts, 21/32" texropes x 56" long (Wigglesworth 316)

Spindle speeds

6 with standard constant speed motor—120, 190, 300, 475, 750 and 1200 rev. p. min.
12 with two-speed pole changing motor—60, 95, 120, 150, 190, 235, 300, 375, 475, 600, 750 and 1200 rev. p. min.
all gears are hardened and ground, consequently smooth running.

Vertical table

Clamping area $7\frac{3}{4}$" by $21\frac{5}{8}$", movement horizontally $9\frac{7}{8}$", movement vertically $11\frac{5}{8}$".
Feed screws
All of the feed screws are equipped with large dials permitting easy reading. 1 division—.001 inch.

Automatic table feeds with single lever selector

horizontally towards either side and vertically upwards and down wards with stopdogs and safety stops arranged for automatic throw-out.
Feeds p. min. (Horizontal Feed).
6 with constant speed motor
5/8", 15/16", 1.3/8", 2.3/32", 3.1/8" and 4.3/4".
12 with two-speed pole changing motor
5/16", 15/32", 5/8", 11/16", 15/16", 1.1/32", 1.3/8", 1.9/16", 2.3/32, 2.3/8, 3.1/8 and 4.3/4".
Feeds p. min. (Vertical Feed).
6 with constant speed motor
3/4", 1.3/16", 1.3/4", 2.5/8, 4", and 6.1/32".
12 with two-speed pole changing motor
3/8", 19/32", 3/4", 7/8", 1.3/16," 1.5/16", 1.3/4", 2", 2.5/8", 3", 4", and 6.1/32".

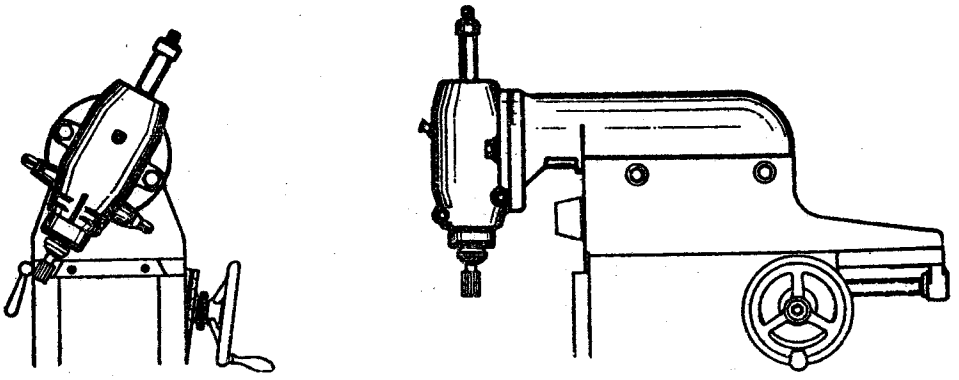
Dimensions and weights

Height of machine	55"
" " " with vertical milling head	60½" max.
Space required	40"x40"
Net weight of the machine	appr. 1240 lbs.
" " " " " incl. accessories	" 2080 "
Weight of packing	" 300 "
Dimensions of packing case	60 x 40 x 34 "

ADDITIONAL ATTACHMENT

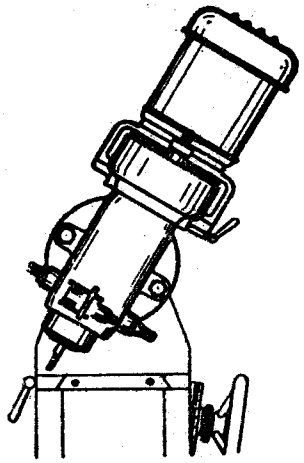
Vertical Milling Attachment

6 or 12 changes of spindle speeds : 190—1900 or 95—1900. Can be swivelled to either side.



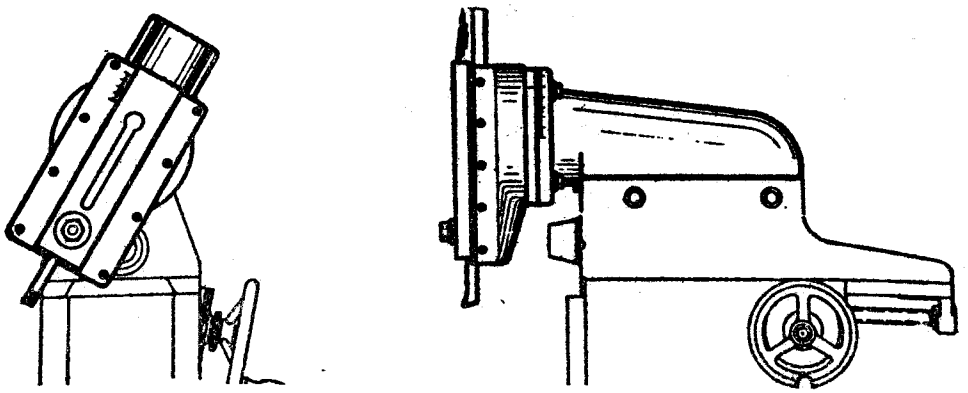
High Speed Vertical Head.

6 changes of spindle speeds : 1900 to 6000 p. m. can be swivelled to either side.



Slotting Device

6 or 12 strokes ranging from 48—480 or 24—480 p. min.
Height of stroke adjustable from 0 to 3 inches.



ADDITIONAL ATTACHMENTS

Vertical Milling Head :

Spindle revolutions per minute :
6 with standard constant speed motor : 190, 300, 475, 750, 1200 and 1900.
12 with two-speed pole changing motor : 95, 150, 190, 235, 300, 375, 475, 600, 750, 950, 1200 and 1900.
Spindle swivels to both sides, vertically adjustable up to $2\frac{3}{4}$". Longitudinal motion of spindle head 6". Adapted for standard spring collets of up to 11/16" bore. Morse taper 4.

Slotting Device :

Stroke vertically adjustable from 0" to 3".
Strokes per minute :
6 with standard constant speed motor : 48 to 475.
12 with two-speed pole changing motor : 24 to 475.
Tiltable to both sides. Longitudinal motion of spindle head 6".

High Speed Vertical Cutter Head :

Spindle revolutions p.min. 1900, 2350, 3000, 3750, 4750 and 6000
with separate drive by flanged motor $\frac{1}{2}$ H.P., 2800 n, spindle tiltable to both sides,
vertically adjustable up to $2\frac{3}{4}$", longitudinal motion of spindle head 10",
adapted for $\frac{3}{4}$" outside dia. spring collets, max. bore $\frac{1}{2}$".

Special Equipment :

Profiling Device consisting of guide pins to be attached horizontally and vertically.

Device for boring and milling to stops,

comprising :
1 end gauge stop and 1 measuring scale each
for the movement of the cutter spindle,
,, ,, vertical and
,, ,, horizontal movement of the working table.
Dial test indicators with $\frac{1}{8}$" measuring range, .001" reading.
$\frac{1}{8}$" measuring range, .001" reading.
Scales for the horizontal movement of the spindle head and horizontal and vertical movement of the table, together with the necessary block gauge carrying bracket, are part of the standard equipment. We can, however, provide at an additional cost accurately calibrated gauge blocks and dial gauges for jig boring purposes. We can provide the dial gauges in either metric or English reading. These dial gauges are gripped by the stem in the gauge carrying bracket.

Eccentric Boring Chuck

Size of tools : 5/16" square or 13/32" round. Graduated in .001" (.002" on dia.).

High Speed Head

Vertical movement : $2\frac{3}{4}$".

Vertical Head

Vertical movement : $2\frac{3}{4}$".

WORK MOUNTING FACILITIES

Angular Working Table

Can be swivelled to all sides-

Size 1-

Clamping area $10\frac{3}{8}$ by 17.2"

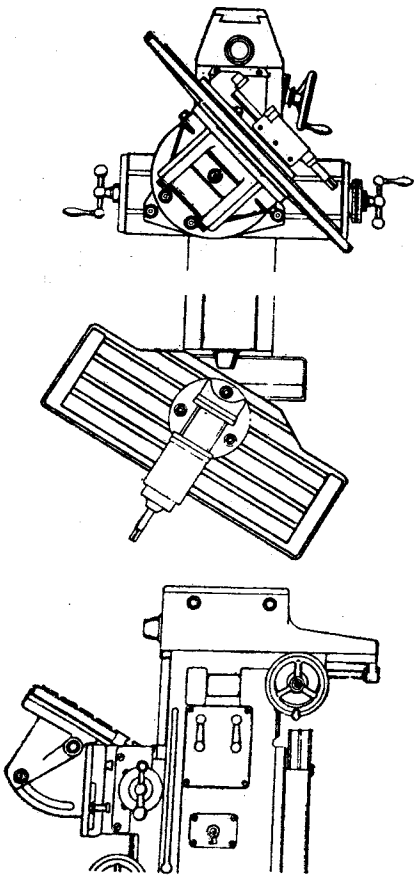
Size 2-

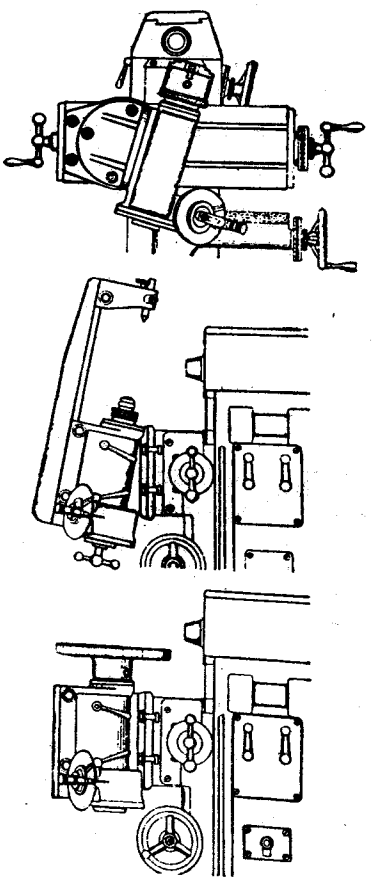
Clamping area $10\frac{3}{8}$ by 24"

Dividing Head

for direct and indirect dividing.

with three jaw chuck collet chuck and face plate can be swivelled to all sides.





WORK MOUNTING FACILITIES

Angular Working Table of Tiltable Design :

Clamping face $10\frac{1}{4}$" by 24", 5 T-slots.
Distance from centre of spindle to surface of table $11\frac{5}{8}$".
Table swivels in 3 directions :
Horizontally to both sides 30 deg. each.
Vertically to both sides 45 ,, ,,
,, forward and
toward the machine .. 30 ,, ,,

Dividing Head designed for Direct and Indirect Spacing :

Direct spacing by scale with 360 divisions and by index with 12 notches ; indirect spacing by worm gear with 3 dividing plates. No. of Plates : 3. No. of Holes : 58, 40, 37, 36 ; 46, 42, 39, 38, 33 ; 43, 41, 34, 31, 27.
Distance between centre of spindle and face of vertical table : 3.17/32".
Distance between support arm and face of vertical-table : 7.7/16".
Adjustable sideways .. .. by 90 deg. each. Morse taper 4.
,, forward .. .. ,, 15 ,, Spindle adapted for standard spring
,, towards the machine.. ,, 8 ,, collets of up to 11/16" bore diameter.
Arbor support for milling axial work, maximum distance 10", gap 4".

Additional Equipment for Dividing Head :

Three-jaw chuch, 4" dia., clamping capacity approx. 5".

Punch Milling Device :

Dia. of Circular Plate : 5".
Top Throw : $1\frac{3}{4}$".
Range of vernier : E : 2" R.M. 50 mm. R.
English Graticule : .005" and 7.7/16".
Metric ,, .20 mm. and .50 mm.
Fine Adjustment : $\frac{1}{4}$" each way.

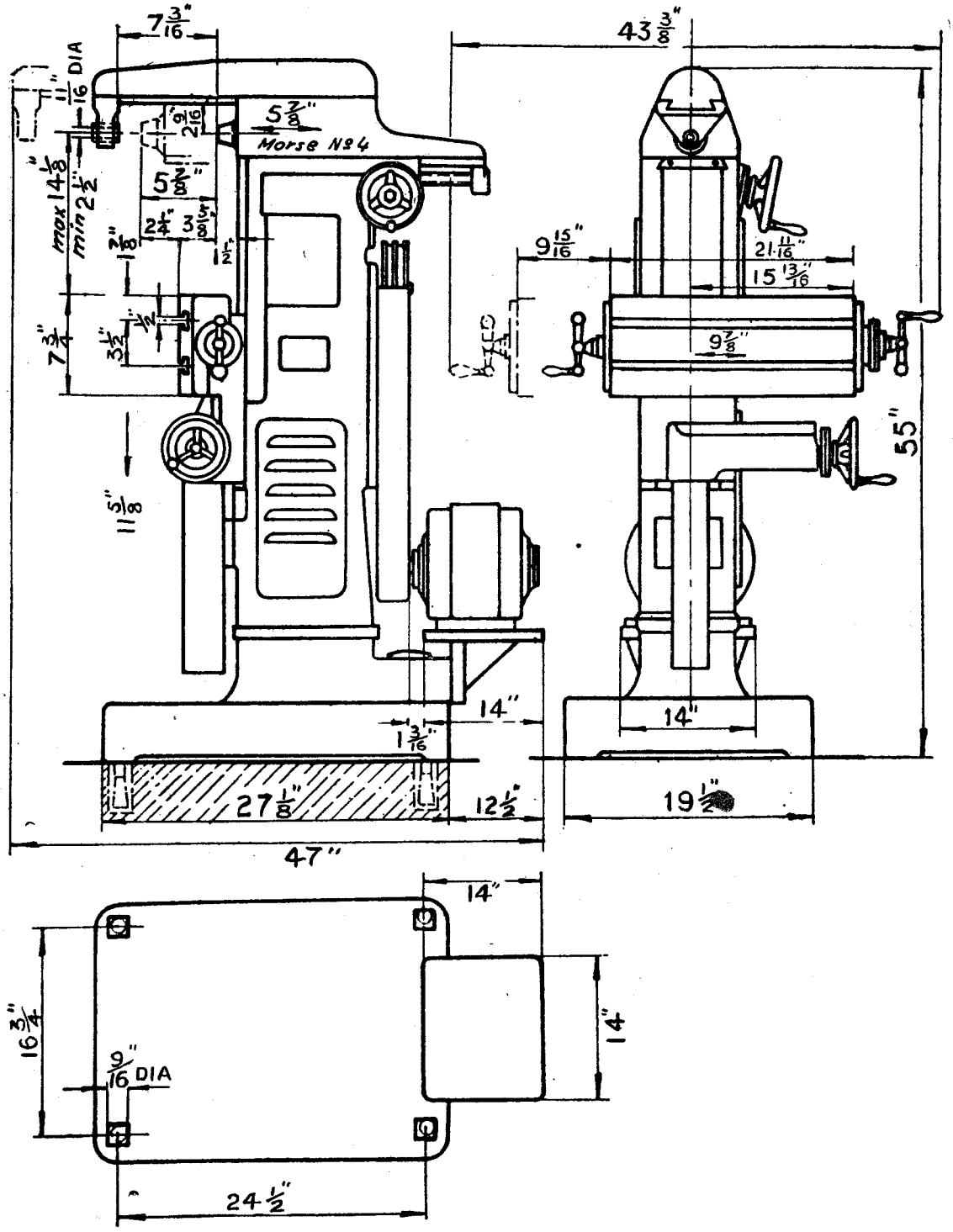
Swivel Vice :

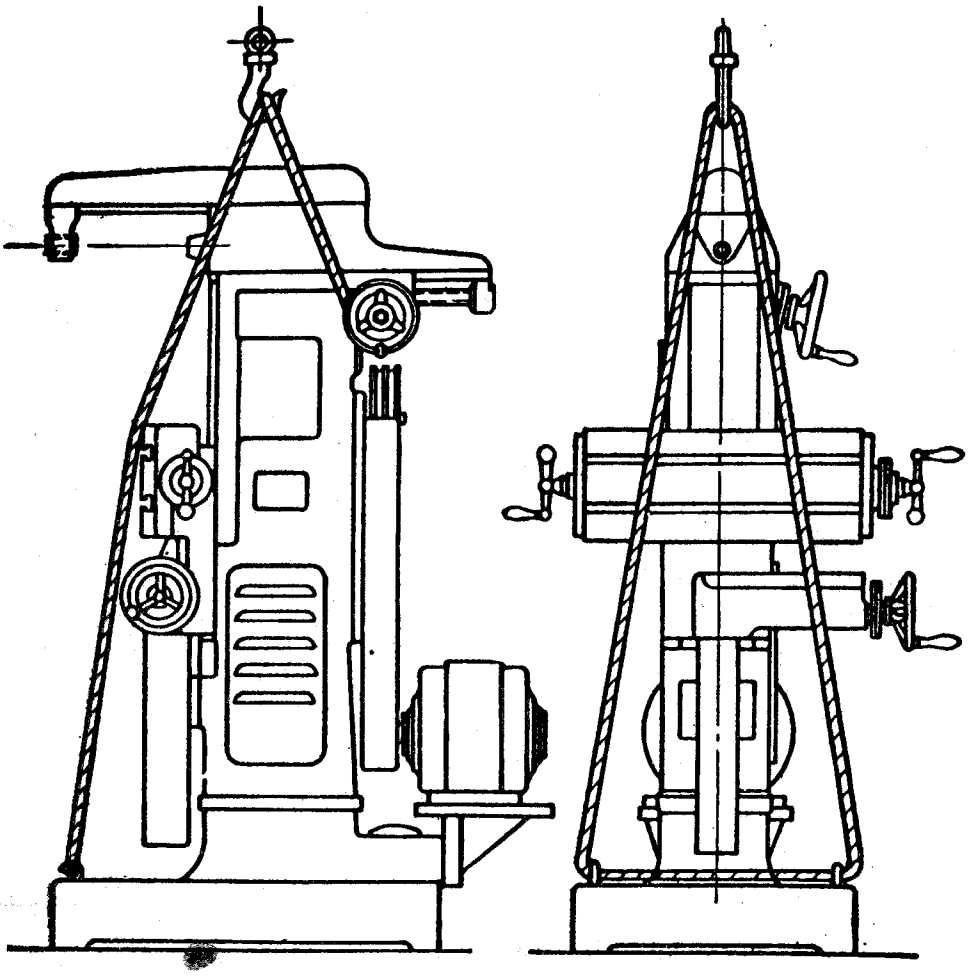
Swivels 90° each way.
Maximum opening of Jaws : 3".
Width of Jaws : $4\frac{1}{4}$".

Circular Dividing Table :

Diameter of Work-table : 14.15/16".
Hand Feed. Number of Dividing Plates : 3.
Holes as Dividing Head.

GENERAL OVERALL DIMENSIONS AND FOUNDATION PLAN

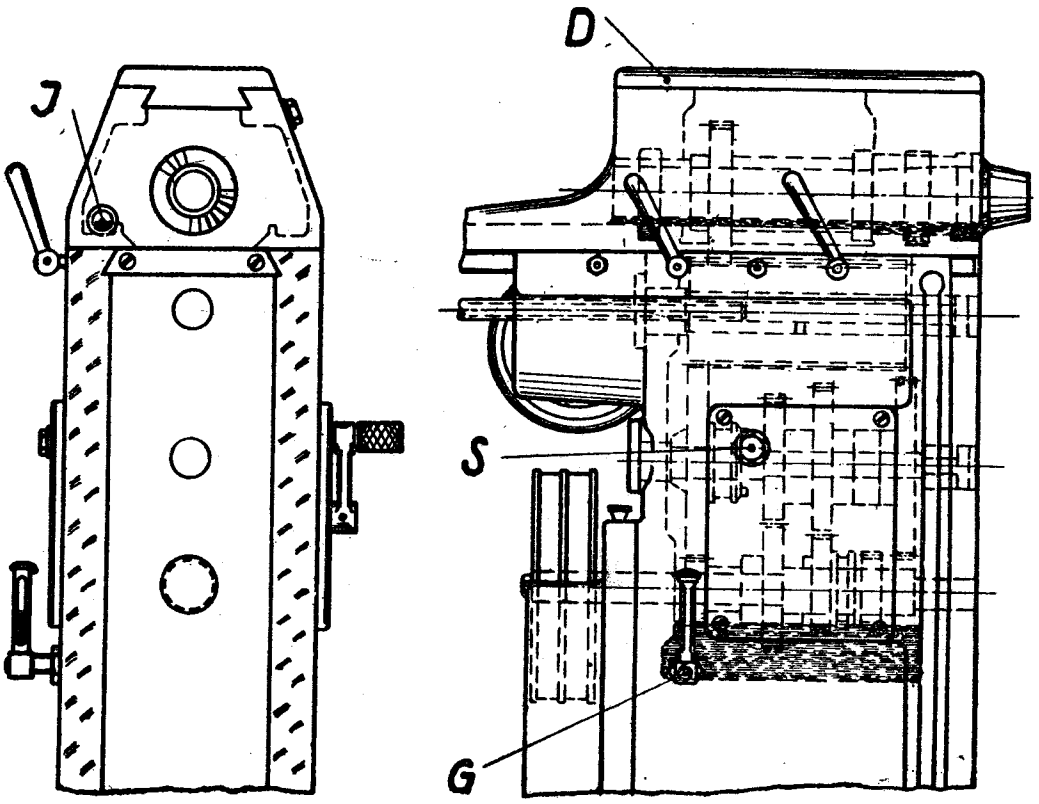




Being a precision machine tool, the machine must be unpacked and transported with the utmost care. The machine is easily moved to its place of erection by means of a crow bar, which must be applied under the foot of the machine and by means of rollers. For slinging, the machine must be roped around the body or, if need be, by the milling head. But under no circumstances must working parts of the machine like spindles, hand wheels, work table supports, etc., be used as points of application for lifting the machine or transporting it, or else the precision of the machine will suffer.

ALSO WHEN LIFTING BY CRANE THE EASILY DAMAGED PARTS MUST BE CAREFULLY WATCHED. IN NO CASE MUST THE WORK TABLE BE USED TO SUSPEND THE MACHINE. THE BEST WAY OF SLINGING THE MACHINE IS THAT SHOWN IN THE ABOVE DRAWING.

LUBRICATION OF GEARING AND CUTTER SPINDLE



Before starting work with the machine the gear-box and oil wells of the cutter spindle bearing must be supplied with oil.

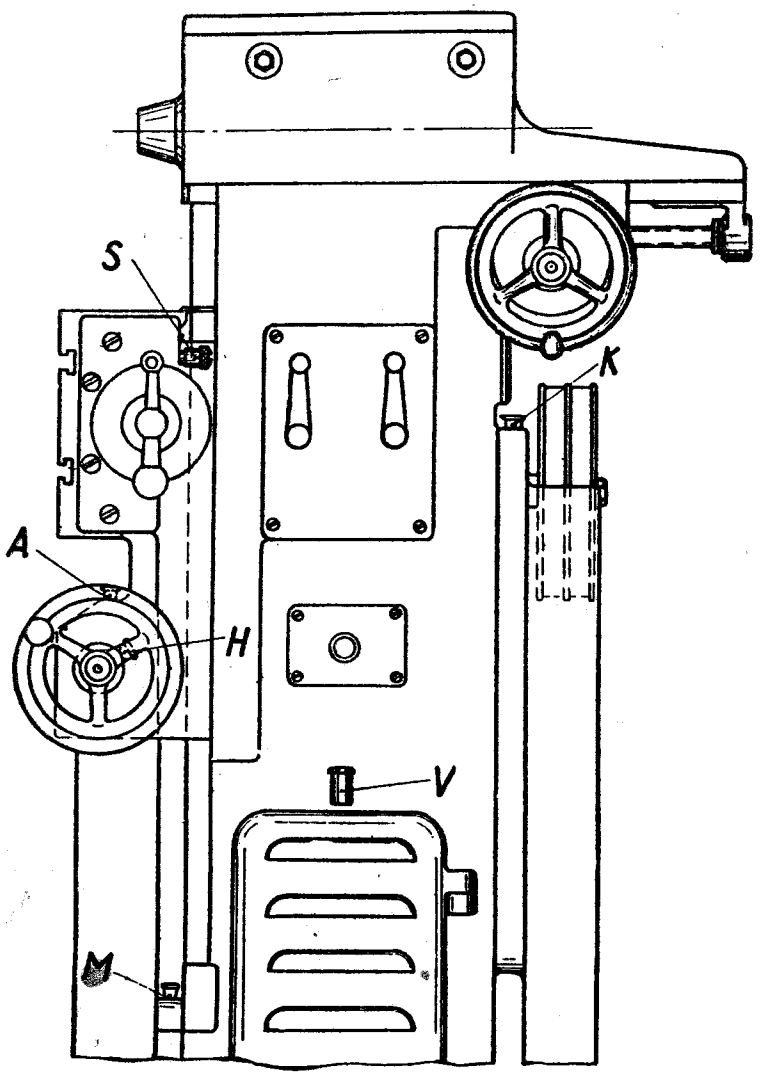
The gear-box is filled up to the middle of the oil-gauge glass G with 2¾ pints (about 1.5 litres) of gear oil and should be kept at this level during operation. The oil is filled in through the gear box cover after removal of screw S.

The gear oil must be renewed at regular intervals. The oil can be drained off after removing the drain screw on the oil gauge or by tilting the oil gauge. Before filling in fresh oil the gear-box must be thoroughly rinsed with kerosine. Regular cleaning and the employment of only reliable and high-grade oils will ensure long life of the gears.

The first time the oil wells are filled the cover D must be removed and the oil can then be filled into the oil pocket at the side of the horizontal spindle. The oil level in the oil wells can be checked through a window J at the front of the cutter spindle support. The oil should not be allowed to sink below the lower edge of this window.

For filling up the oil level, which should be done daily, it will suffice to run the machine a few minutes at 750 r.p.m., the spindle bracket being adjusted to about 1" of the graduated scale (pointer at centre of clamping screw).

LUBRICATION OF SUPPORT AND FEED DRIVING GEAR.

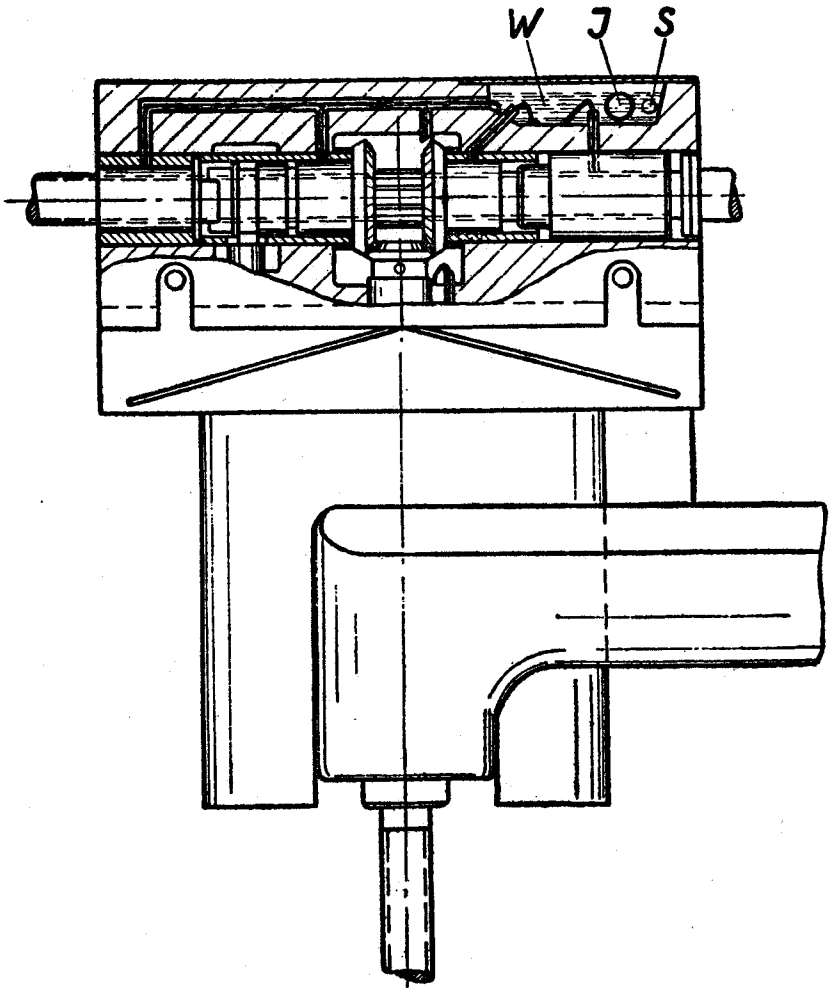


When using the machine, the oil tray in the support is to be filled daily through lubricator S. From here the oil is fed by wicks to the journals of the bevel gears, the spindles and the working table guide. (See page 11).

Lubricator V oils the journals of the feed driving gear, Lubricator M, the lower bevel gears and the elevating spindle nut. If necessary these parts are to be lubricated daily.

The driving chain to the feed driving gear is to be oiled through lubricator K. The bevel gear shaft through lubricator H and the bevel gears through lubricator A.

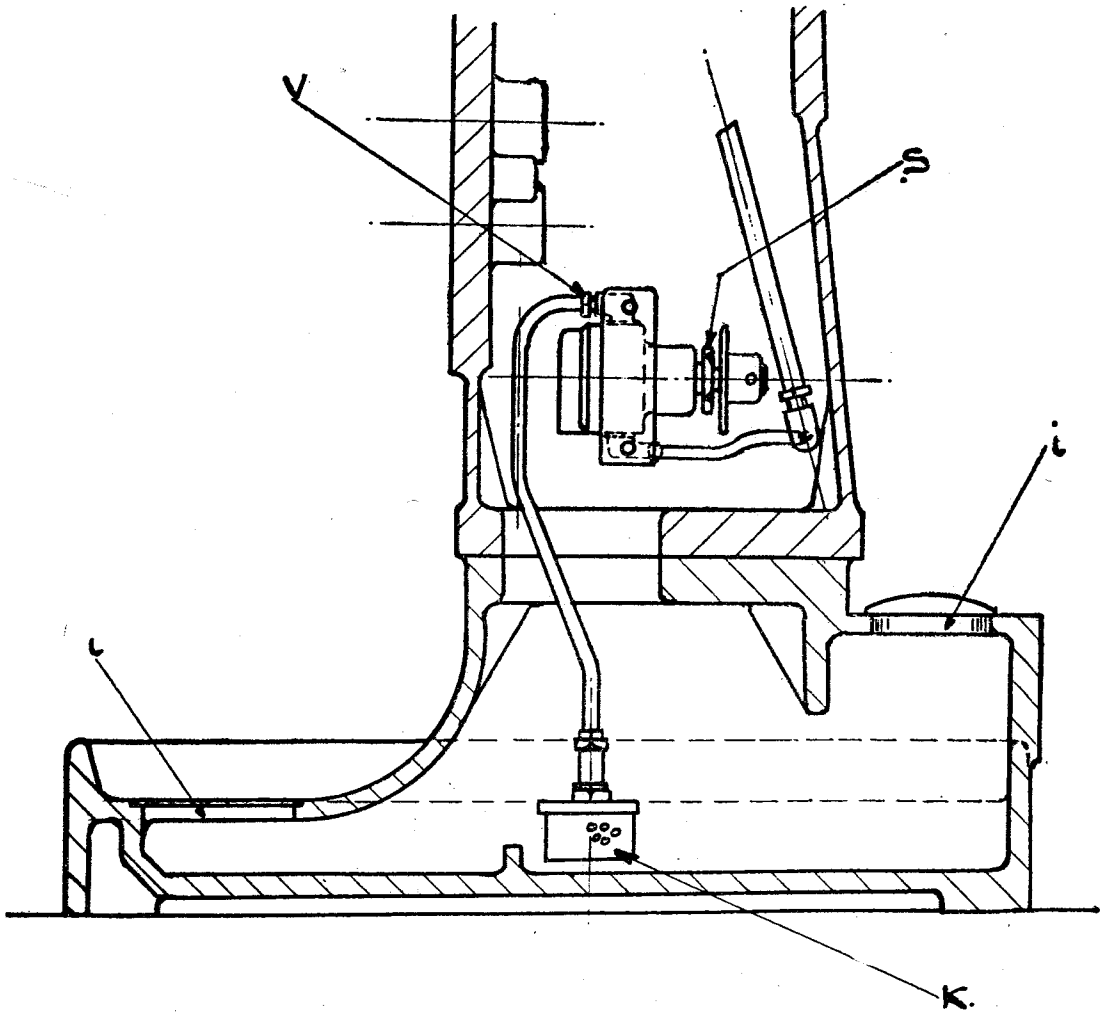
LUBRICATION OF THE SUPPORT



All journals in the support are provided with oil by the oil-tray W, which for this reason must always have a sufficient quantity of oil.

The journals are filled up in such a manner that the inspection glass J is completely covered with oil.

COOLANT PUMP



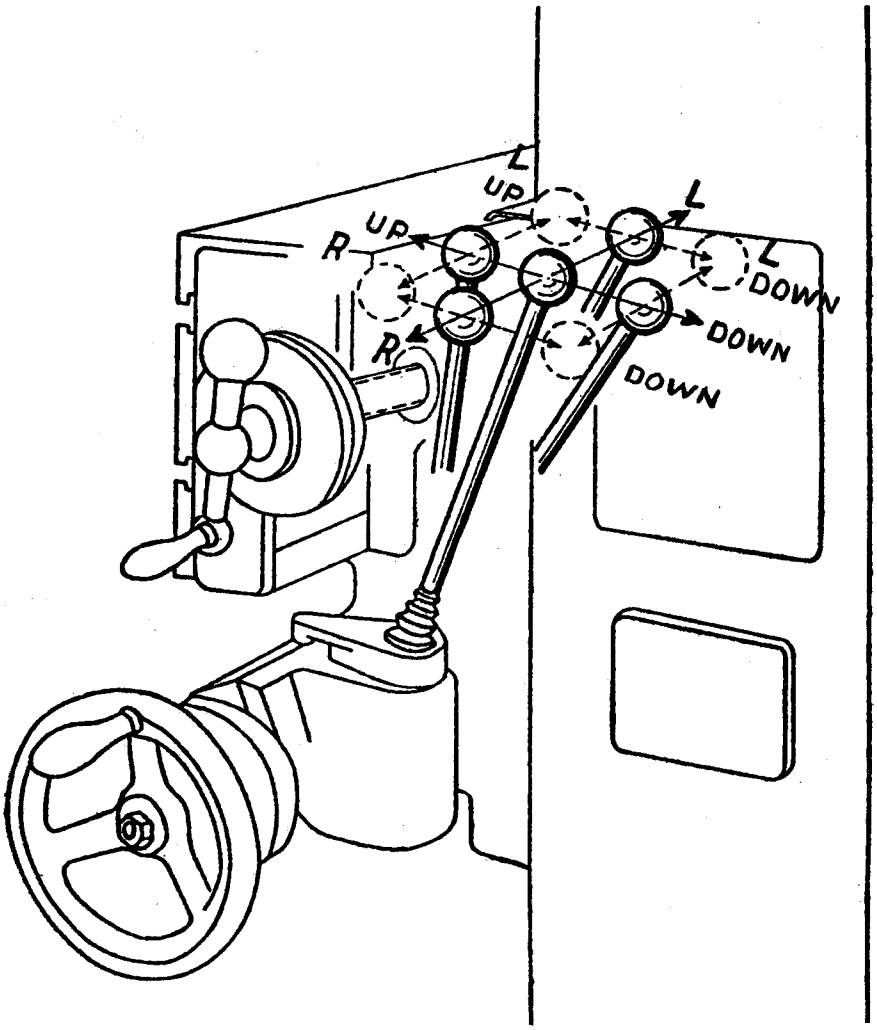
The coolant is circulated by means of a pump built into the machine base. The pump is positively driven from the machine by a chain. If not required for a long period, the pump can be disconnected by removing the chain.

An oil emulsion is generally employed as coolant and can be filled into the chamber in the machine base. When starting work for the first time or in case the pump does not deliver, it is recommended to prime the pump by pouring coolant into the pipe from above, until the pump begins to work.

After the pump has been running for a considerable time, gland S of the pump must be tightened up by turning with a spanner in a clockwise direction. At regular intervals, depending on the amount of dirt in the coolant, the strainer K must be removed, after unscrewing union V, and thoroughly cleaned. The accumulated chips can be removed through the opening i in the base.

SINGLE LEVER FEED

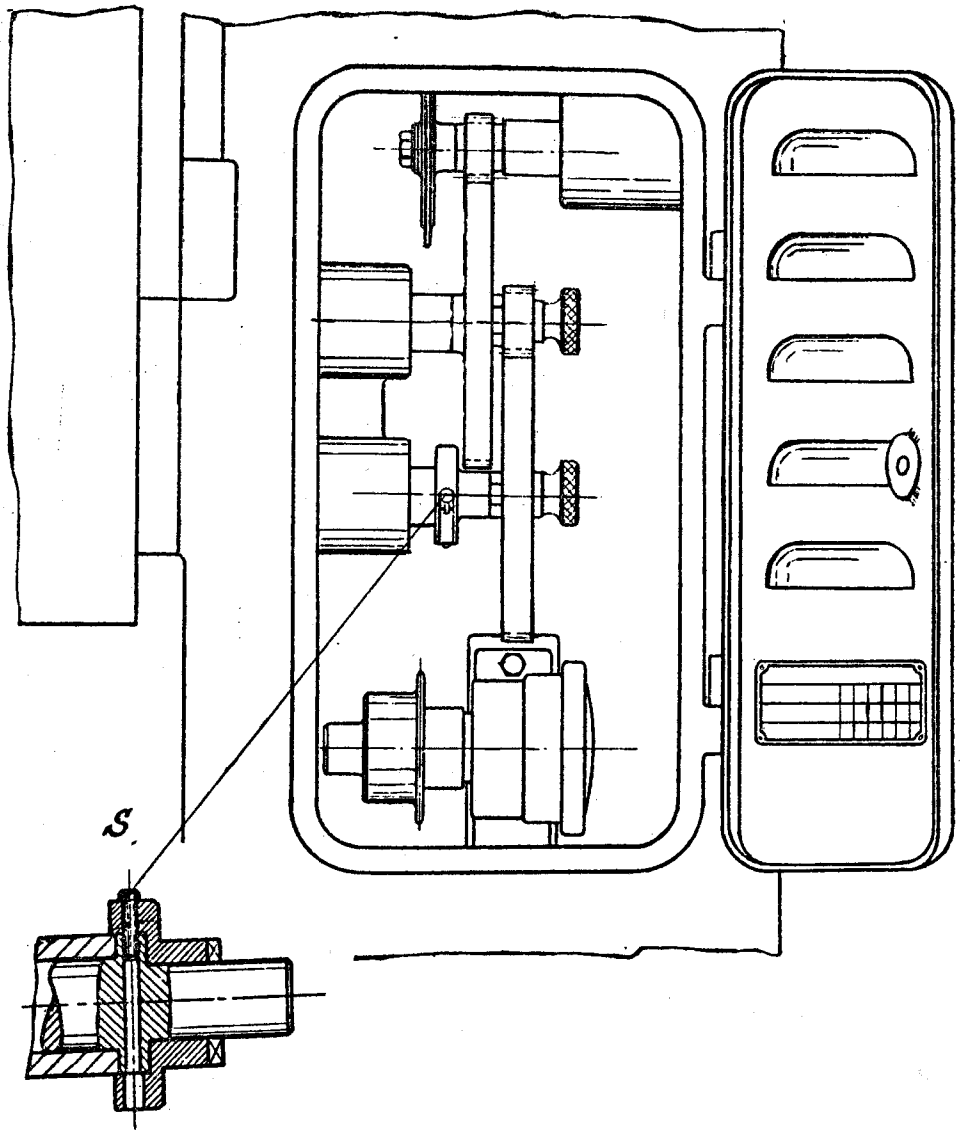
All movements viewed from the front.



The single lever feed makes it possible to effect all feed motions of the work table from one and the same place. The paths of the operating lever for left and right, up and down, are adapted conveniently to the directions of motion of the work table.

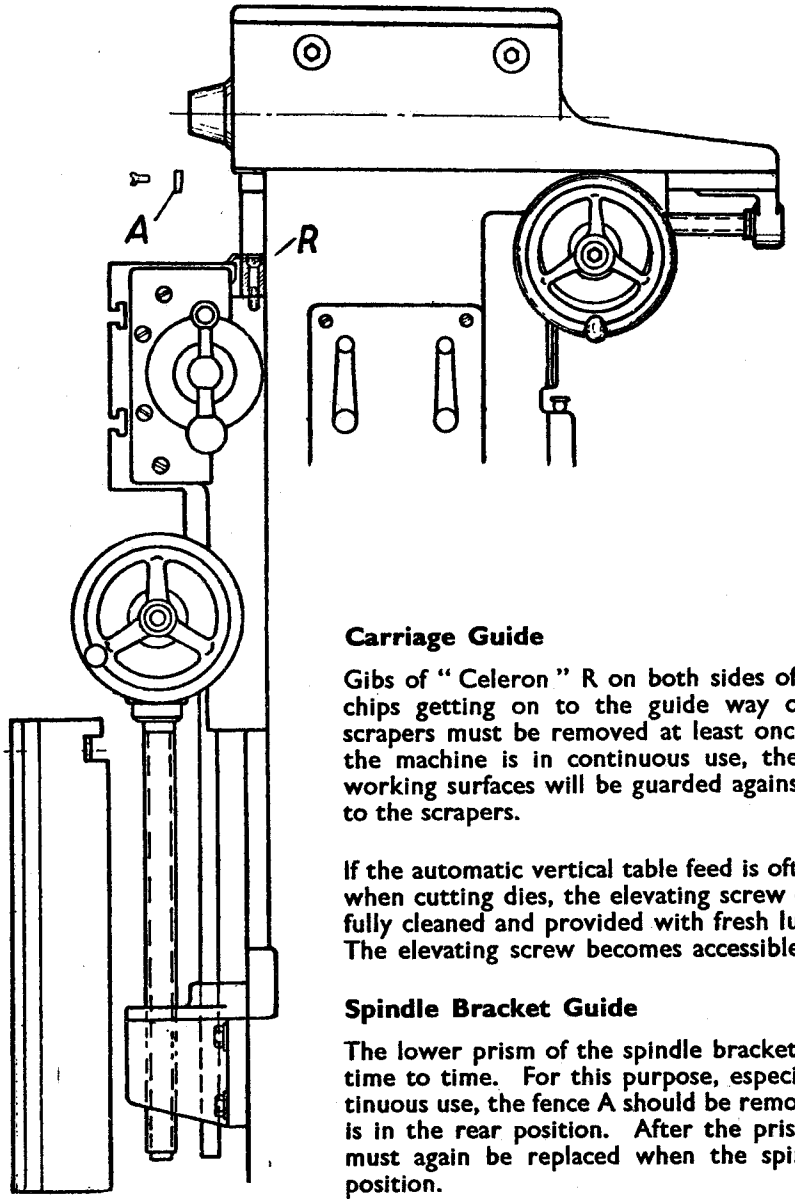
Apart from the four main motions of the work table—vertically and horizontally—oblique motions may also be effected, the desired transverse direction being effected from a given main position.

In this manner two table advances are effected, so that the work table moves upwards to the left, downwards to the left, upwards to the right, or downwards to the right at an angle of 45 deg.



On to the inner side of the door of the change gear-box a chart is fixed which tells which wheels are to be set for the particular table feeds. For the preservation of the automatic drive, when not in use, a wheel can easily be disconnected therefrom.

The feed gear is protected against over-loading by a simple shearing bolt S of mild steel. A sheared-off bolt can be easily taken out after having swivel'ed aside the safety spring and replacing the same by a new one



Carriage Guide

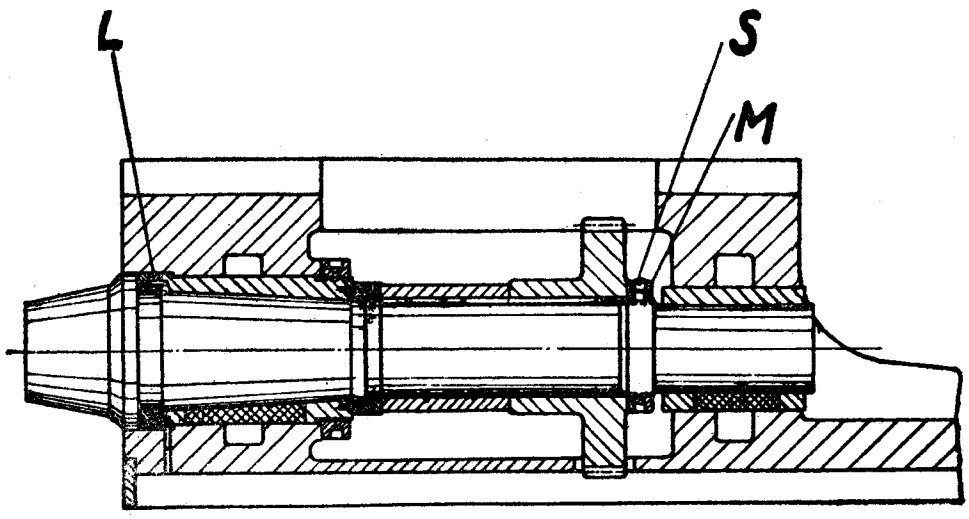
Gibs of " Celeron " R on both sides of the prismatic guide prevent chips getting on to the guide way of the carriage. These chip scrapers must be removed at least once a week and cleaned, and if the machine is in continuous use, then oftener. In this way the working surfaces will be guarded against damage from chips clinging to the scrapers.

If the automatic vertical table feed is often employed, as for instance, when cutting dies, the elevating screw of the carriage must be carefully cleaned and provided with fresh lubricant at least once a week. The elevating screw becomes accessible after removal of the guard.

Spindle Bracket Guide

The lower prism of the spindle bracket must be freed of chips from time to time. For this purpose, especially if the machine is in continuous use, the fence A should be removed when the spindle bracket is in the rear position. After the prism has been cleaned, fence A must again be replaced when the spindle bracket is in the front position.

RE-ADJUSTING THE HORIZONTAL MILLING SPINDLE BEARING

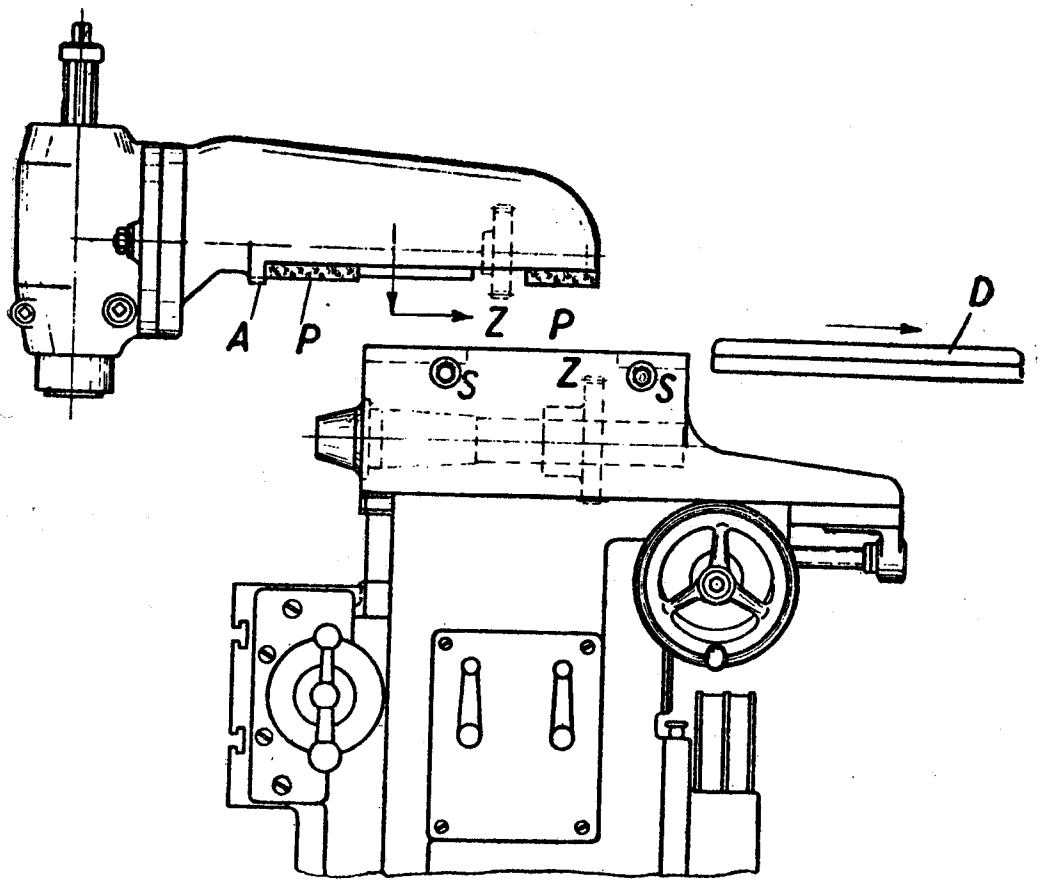


To take up the radial pressures, the horizontal milling spindle possesses a strong cone pin housed in a bronze bush, whilst the axial pressures are taken up by adjustable spacing rings. If after prolonged use an enlargement of the bearing play becomes noticeable, or if the milling spindle is set too tight, one should proceed as follows when re-adjusting the spindle :—

After unscrewing the safety screw S, the bearing can be adjusted by turning the nut M. After adjustment the screw S must be screwed tight again. The bearing can be re-adjusted so far that with a tight radial fit with a play of bearing not passing beyond .0004" at the most the play of the axial bearing does not exceed .0008".

If it should not be possible to get a tight radial fit in this manner, the spacing ring L must be re-adjusted, reducing the thickness of the ring by .004", which diminishes the play of the radial bearing by .0004". This necessitates dismounting the milling spindle, which is effected in a simple manner by unscrewing the nut M and pulling the milling spindle forward.

SETTING UP OF THE VERTICAL MILLING ATTACHMENT



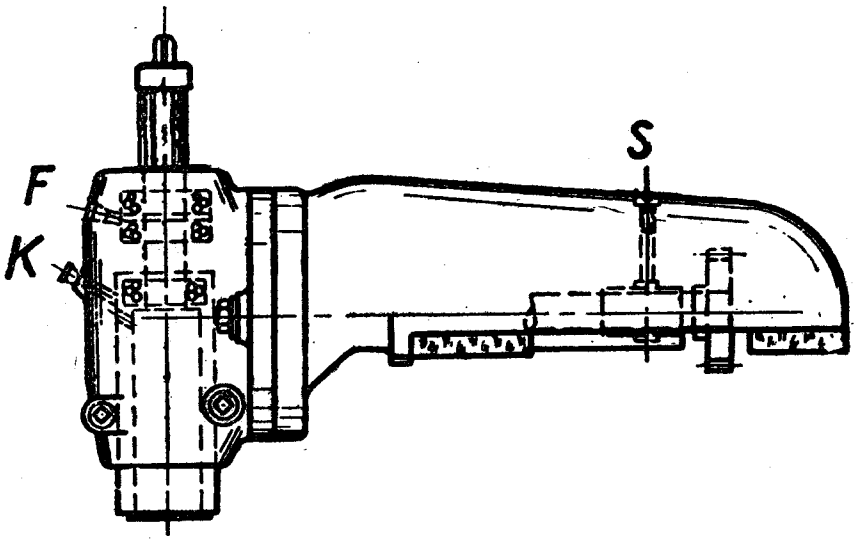
Before setting up the Vertical Milling Attachment, loosen first screws S and then take off Protecting Cap D.

Put gently—from above—the Vertical Milling Attachment on the headstock between the V-ways P, sliding the same up to the stop A in the prismatic guide. In doing so, the two gears Z must mesh, whereby probably a slow turning of the vertical cutter spindle will be necessary.

The attachment is clamped safely by tightening screws S.

Special care should be taken to keep the V-ways and the gear of the vertical milling head perfectly clean, preventing the entering of chips or dirt into the interior of the machine. Having removed the vertical milling head, the protecting cap D is to be replaced immediately.

LUBRICATION OF THE VERTICAL MILLING ATTACHMENT

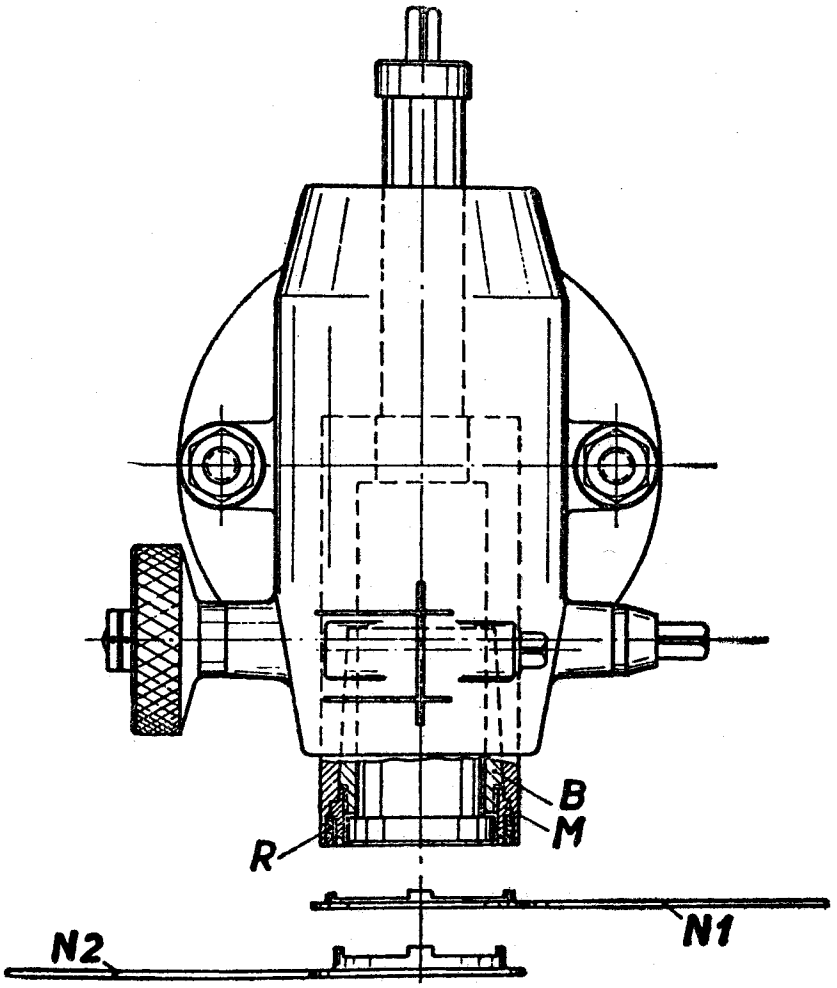


The upper anti-friction bearings of the vertical-milling head are lubricated with grease. A high-pressure grease gun is supplied with the machine, and through nipple F the grease is forced into the anti-friction bearings. The lubrication must be repeated after 200 working hours.

The lower cutter spindle bearing, which is designed as a slide bearing, is fed with oil through lubricator K. When using the milling head, lubricate according to requirement. Excessive lubrication will result in an intense heating of the bearing.

The bearing of the driving shaft is to be oiled from time to time through oil duct S. For this purpose first remove the screw.

ADJUSTMENT OF THE VERTICAL SPINDLE BEARING



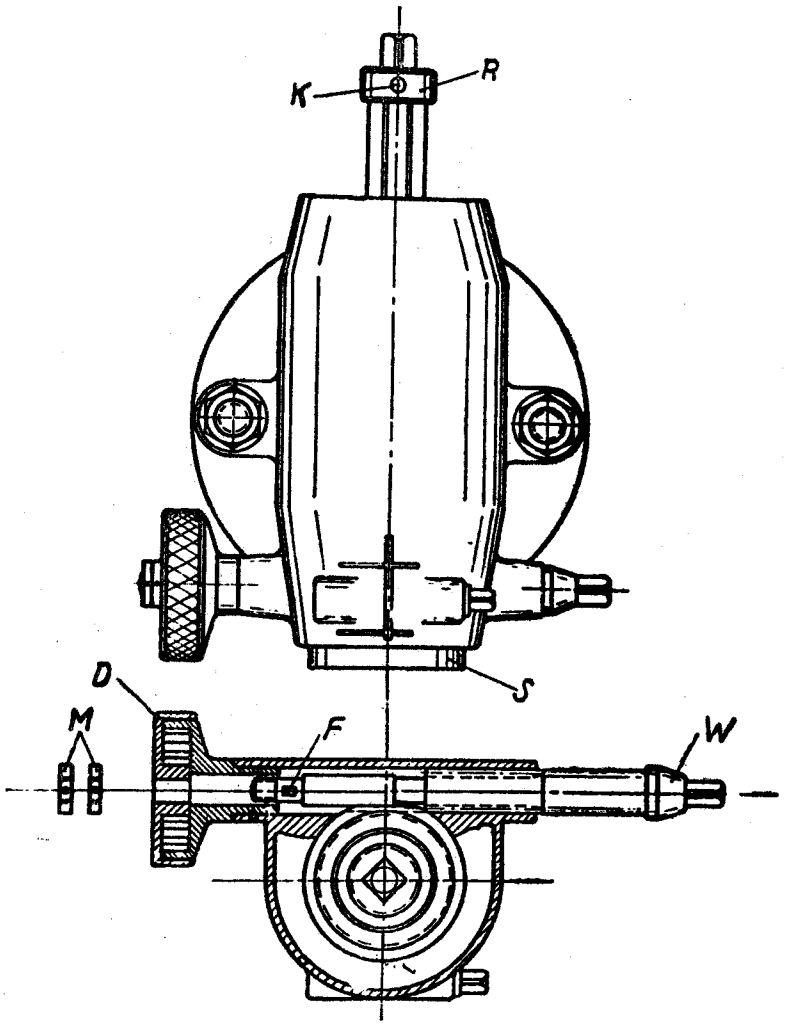
The main bearing of the vertical spindle consists of an adjustable conical sleeve. This spindle is initially assembled with a radial clearance of .0008" and an axial clearance of .0004". Any alteration of this clearance can be compensated for by readjustment of the conical sleeve, which is done as follows :—

First screw out ring R with key N1 ; the conical sleeve B can than be pulled out of the spindle housing through the nut M with the help of key N2.

If the clearance of the bearing is too great the aluminium insert in a slit of the conical sleeve must be correspondingly reduced and the sleeve replaced. If the clearance is too small, which would result in heating up of the spindle bearing, this can be remedied by employing a thicker insert.

After the spindle has been again inserted, the clearance should be checked with a dial micrometer and the screw ring R then tightened up.

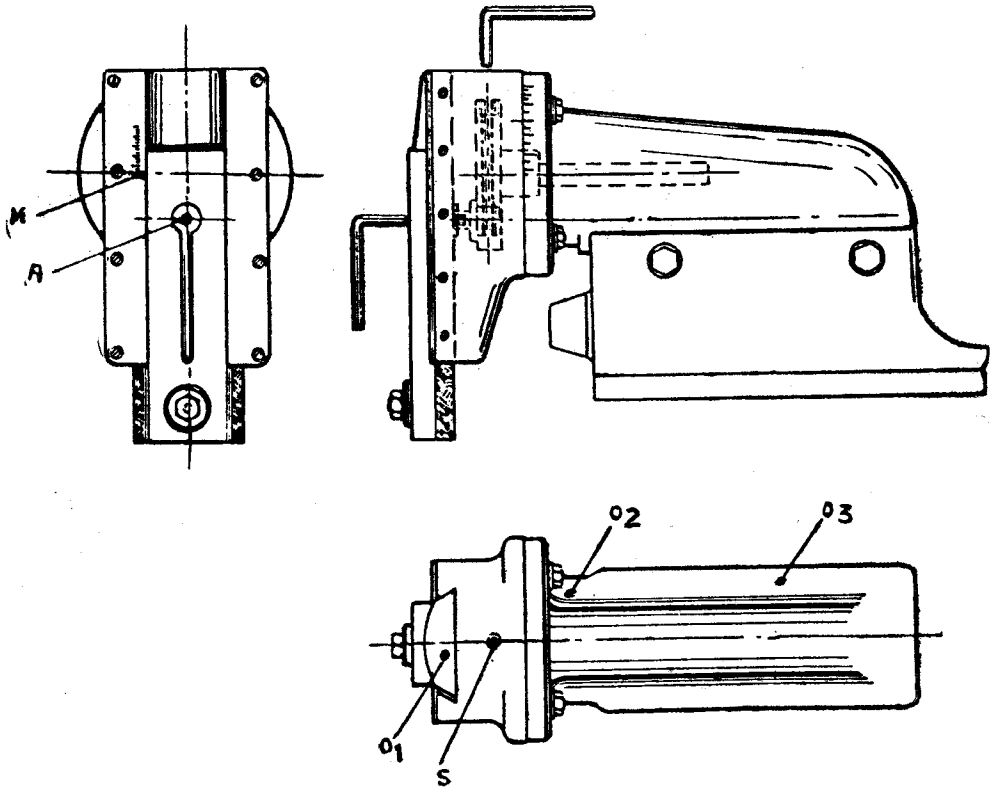
DISMOUNTING THE VERTICAL SPINDLE



So as to be able to dismount the milling spindle, the ring R must be screwed off first after having knocked through the cone pin K. Thereupon the two nuts M are removed and the driving wheel W is pulled out of the casing. Then the milling spindle can be taken out of the milling spindle casing without any difficulty.

To remount the milling spindle, the spindle is introduced first and then the driving wheel W is inserted, but only just deep enough to have the wedge F standing before the keyway. By turning the knurled cap D the spring to pull off is given the proper tension, and without letting the knurled cap go, the driving wheel W is pushed entirely through the cap D. The two nuts M are screwed on again.

DIRECTIONS FOR THE HANDLING OF THE SLOTTING DEVICE

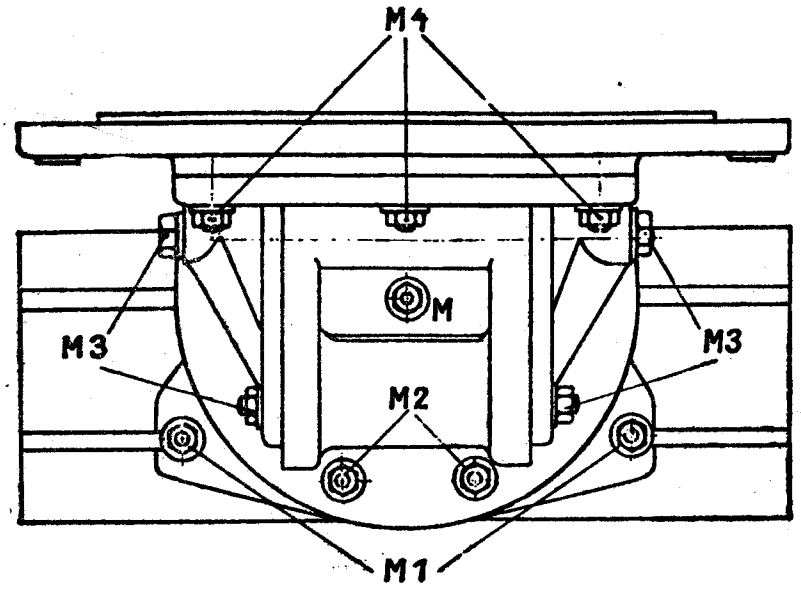


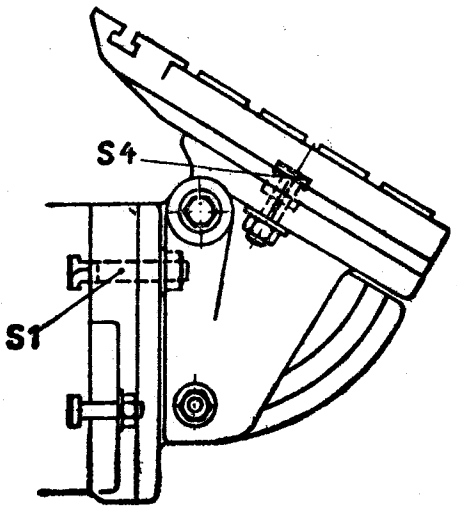
The slotting device is mounted on the spindle block in the same way as the vertical milling spindle (see Page 7).

The stroke can be adjusted directly according to scale. By turning the driving pulley the ram is set in the lowest position and the spindle S is turned in the corresponding direction after loosening screw A. The furnished hexagon pin wrench is used for screw A, as well as for spindle S. Before starting the device tighten again screw A.

About every 20 working hours—or when the device has not been used for some time—a considerable quantity of oil has to be poured into the three places for oil, marked in red.

SWIVELLING ANGULAR TABLE





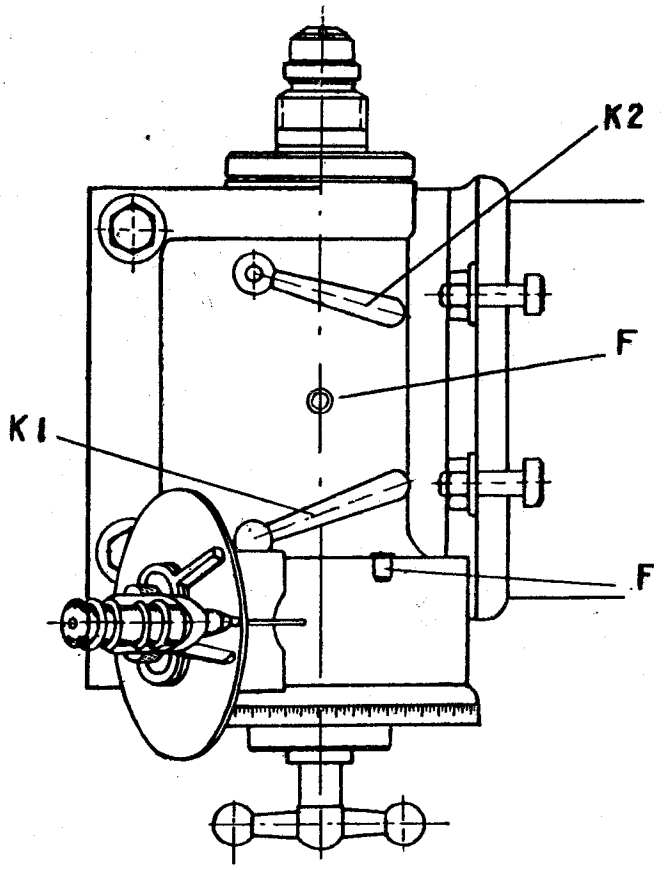
Before attaching the angular table to the machine, screw S1 with nut M must be pulled back into the T-slot ; the nut is unscrewed until the T-bolt S1 is lodged in the T-slot of the vertical table and then drawn np tight.

To swing the table parallel to the vertical table, release the 3 nuts M and M2 and tighten them again after the proper setting is obtained.

To swing the table towards the vertical table, loosen the 4 nuts M3, then set the table to the desired position and tighten the nuts.

The horizontal table may be swivelled 30 deg. to either side and turned 180 deg. on its base. For this purpose release the 3 nuts M4 and swing the table towards T-bolts S4 until the latter drop out of the T-slots and the table may be turned 180 deg. After setting the table to the proper angle replace the T-bolt and tighten 3 nuts M4. It is, however, impossible to swing the table 180 deg. unless the same is tilted forward 30 deg. as shown above.

DIVIDING HEAD



The Dividing Head is designed for direct and indirect dividing as well as for any angular pitch in degrees.

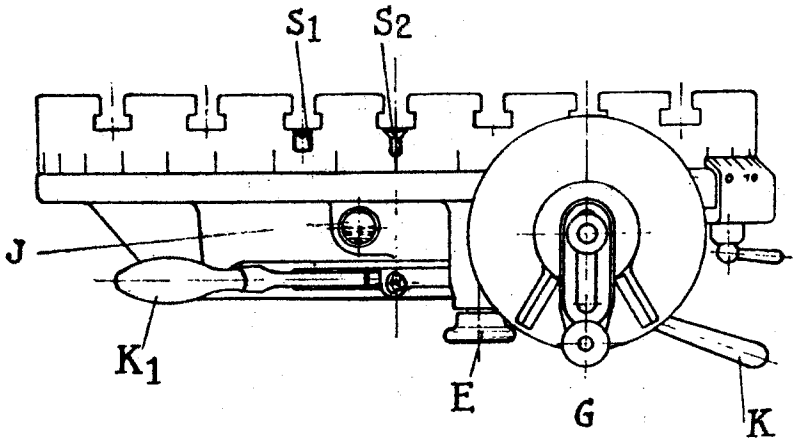
When operating the indirect spacing the worm must be swung into the worm gear after releasing handle K1 by turning the crank handle and index plate clockwise. Care should be taken in engaging the worm to prevent the precise worm gear from being damaged. After swinging to the stop position the worm bearing must again be secured by handle K1.

For direct spacing a disc with 12 notches is provided, which is located in the proper position by means of a dowel pin.

By direct indexing in degrees it is only necessary to set the starting point at zero mark on the disc index the required number of degrees.

In the case of any desired angular pitch, adjustment to the index dash is to be effected according to the scale attached to the notched disc. The spindle of the dividing head can be locked by ball handle K2. The dividing head spindle should always be locked during heavy milling operations. To lubricate the spindle of the dividing head and the worm bearing, pure grease is forced into nipples F by means of the high-pressure grease gun. This is only necessary twice or three times a year.

OPERATION OF THE ROTARY TABLE



This Rotary Table is adapted for direct and indirect indexing as well as for any desired division in degrees.

Indirect Indexing :

When employing the indirect indexing method, adjustment of the rotary table is made with the help of crank handle G through the medium of a worm gear. The worm must first be engaged with the worm wheel, which is done by slackening lever K and then swinging the index plate and crank handle to the left up against the stop.

This engaging of the worm must be done with special care in order to avoid damage to the very accurately finished worm wheel. Above all, see to it that the worm **is moved right up against the stop.** To check whether this is the case, a mark is provided on the eccentric sleeve behind the index plate. Before starting work, lever K must be again tightened up.

Direct Indexing :

When working with the direct indexing method, the worm must first be put out of engagement and clamped in position.
Division can then be made either by engaging indexing pin E with a space plate provided with 24 notches or by means of the scale on the circumference of the rotary table, graduated in 360 degrees. Fine adjustment can be made with the help of a vernier attachment containing 60 divisions corresponding to 59 degrees of the scale, so that any angle down to 1 minute can be exactly set.

Before starting work, always clamp the table in position by means of lever K1, so that the worm as well as the indexing pin is relieved of pressure.

Lubrication :

Worm and worm wheel run in oil. The oil level can be checked at window J. The worm wheel housing is filled with oil before delivery. Any refilling that may be necessary can be done through hole S1. Hole S2 serves for lubrication of the table guides.

DIRECTIONS FOR THE FINE ADJUSTMENT OF THE ZERO POSITION WITH THE HELP OF TRAMMEL AND DIAL GAUGE

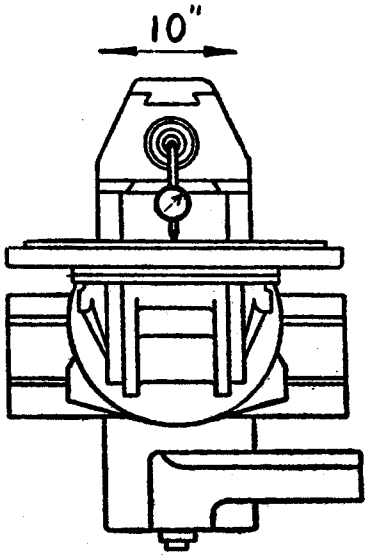


Fig. 1

(a) **Adjustment for accurate horizontal milling** (Figs. 1 and 2).
Set the swivelling work table to zero in three directions ; clamp the dial gauge in the milling spindle collet ; shift the work table 10" in a horizontal direction and 6" transversely with the spindle head, then correct position of table until the dial gauge shows less than .0004" difference. This should only take a few minutes.

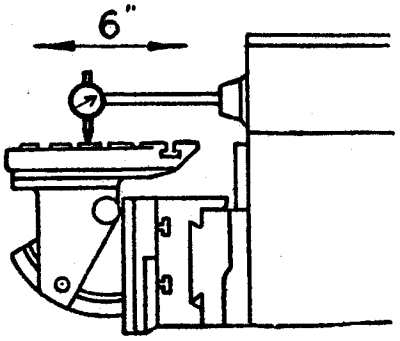


Fig. 2

(b) **Adjustment for accurate work with the dividing head** (Fig. 3).
Set the dividing head to zero in two directions ; insert the trammel ; fix the trammel into milling spindle collet ; shift the dividing head 12" vertically and correct position of the dividing head in both directions until the dial gauge shows less than .0004" difference.

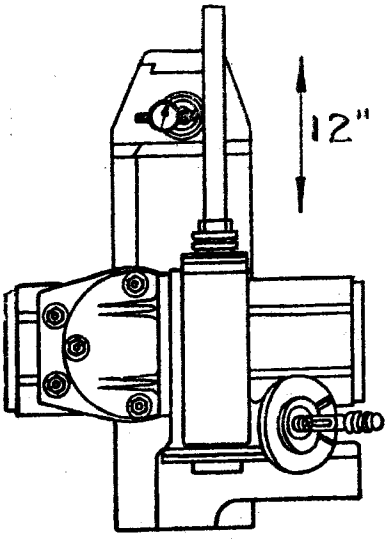


Fig. 3

(c) **Fine adjustment of the vertical position of the milling head** is effected similarly to the adjustment of the dividing head. A trammel is inserted in the vertical spindle, the dial gauge fixed on the vertical table and shifted 12".

TABLE FOR THE DIVIDING HEAD OF THE MASTER TOOL UNIVERSAL MILLING MACHINE

Number of parts	Division in degrees	Turns of Crank Handle										
		in full	in fractions									
2	180°	20	—	—	—	—	—	—	—	—	—	—
	175°	19	17/27									
	170°	18	24/27									
	160°	17	21/27									
	150°	16	18/27									
	140°	15	15/27									
	130°	14	12/27									
	125°	13	24/27									
3	120°	13	9/27			11/33	13/39	14/42	12/36			
	110°	12	6/27									
	100°	11	3/27									
4	90°	10										
	80°	8	24/27									
	75°	8	9/27			11/33	13/39	14/42	12/36			
5	72°	8										
	70°	7	21/27									
	65°	7	6/27									
6	60°	6	18/27			22/33	26/39	28/42	24/36			
	55°	6	3/27									
7	—	5						30/42				
	50°	5	15/27									
8	45°	5										
9	40°	4	12/27						16/36			
10	36°	4										
	35°	3	24/27									
11	—	3				21/33						
12	30°	3	9/27			11/33	13/39	14/42	12/36			
13		3					3/39					
14		2						36/42				
	25°	2	21/27									
15	24°	2	18/27			22/33	26/39	28/42	24/36			
16		2		17/34		19/38	21/42	23/46	18/36	20/40	29/58	
17		2		12/34								
18	20°	2	6/27						8/36			
19		2				4/38						
20	18°	2										
	16°	1	21/27									
21		1						38/42				
22		1				27/33						
23		1						34/46				
24	15°	1	18/27			22/33	26/39	28/42	24/36			
25		1								24/40		
26		1					21/39					
27		1	13/27									
28		1						18/42				
29		1									22/58	
30	12°	1	9/27			11/33	13/39	14/42	12/36			
31		1										
32		1							9/36	10/40		
33		1				7/33						
34		1										

Number of parts	Division in degrees	Turns of Crank Handle										
		in full	in fractions									
35		1							6/42			
36	10°	1	3/27							4/36		
37		1				3/37						
38		1				2/38						
39		1				1/39						
40	9°	1										
41		—			40/41							
42		—							40/42			
43		—			40/43							
44		—				30/33						
45	8°	—	24/27							32/36		
46		—							40/46			
48		—							35/42	30/36		
50		—									32/40	
	7°	—	21/27							28/36		
52		—					30/39					
54		—	20/27									
55		—				24/33						
56		—							30/42			
58		—										40/58
60	6°	—	18/27									
62		—		20/31								
64		—									25/40	
65		—					24/39					
66		—				20/33						
68		—		20/34								
70		—							24/42			
72	5°	—	15/27							20/36		
74		—								20/37		
76		—				20/38						
78		—					20/39					
80		—		17/34		19/38	21/42	23/46	18/36	20/40	29/58	
82		—			20/41							
84		—							20/42			
85		—		16/34								
86		—			20/43							
88		—				15/33						
90	4°	—	12/27							16/36		
92		—							20/46			
95		—				16/38						
96		—								15/36		
100		—									16/40	
120	3°	—	9/27			11/33	13/39	14/42	12/36			
180	2°	—	6/27							8/36		
200		—									8/40	
240		—								6/36		
270		—	4/27									
360	1°	—	3/27									
	40'	—	2/27									
	30'	—								2/36		
	20'	—	1/27									

Pitch-diameter: 27, 31, 34, 41, 43 / 33, 38, 39, 42, 46 / 36, 37, 40, 58

The denominators of the fractions indicate the pitch-diameter: For instance: 6/27 = number of pitches / pitch-diameter

WORKING DIRECTIONS :

The table shows adjustments, for simple divisions from 2—360 parts and divisions in degrees from 20'—180 deg., using the indirect method of division.
Supposing an object has to be divided in 18 parts or in 20 deg. The table indicates : 2 6/27 or 2 8/36 turns of the crank handle. The index of the crank handle is set on the pitch circle 27 or 36. The crank handle is turned two full turns, and then 6 respectively 8 holes to the right or left.
To avoid errors in division, fingers are provided on the division plate, which are set in such a manner, that one foot touches with is innerside at the index pin. while the other foot encompasses as many free holes to the right or left, as the crank is supposed to be turned. Before each following division, the fingers are to be turned again, up to the notch pin.
The division worm can be disengaged by turning the division plate to the left, after having loosened the tommy-screw.

TABLE FOR THE ROTARY TABLE

Number of parts	Division in degrees	Turns of Crank Handle: in full	in fractions									
2	180°	45										
	175°	43							27/36		30/40	
	160°	40										
	150°	37		17/34		19/38	21/42	23/46	18/36	20/40	29/58	
	140°	35										
	135°	33							27/36	30/40		
	130°	32		17/34		19/38	21/42	23/46	18/36	20/40	29/58	
	125°	31							9/36	10/40		
3	120°	30										
	110°	27		17/34		19/38	21/42	23/46	18/36	20/40	29/58	
	100°	25										
4	90°	22		17/34		19/38	21/42	23/46	18/36	20/40	29/58	
	80°	20										
	75°	18							27/36	30/40		
5	72°	18										
	70°	17		17/34		19/38	21/42	23/46	18/36	20/40	29/58	
	67° 30'	16								35/40		
	65°	16							9/36	10/40		
6	60°	15										
	55°	13							27/36	30/40		
7	—	12									36/42	
	50°	12		17/34		19/38	21/42	23/46	18/36	20/40	29/58	
8	45°	11							9/36	10/40		
9	40°	10										
10	36°	9										
	35°	8							27/36	30/40		
11	—	8				6/33						
12	30°	7		17/34		19/38	21/42	23/46	18/36	20/40	29/58	
13		6					36/39					
14		6					18/42					
	25°	6							9/36	10/40		
15	24°	6										
16		5								25/40		
17		5		10/34								
18	20°	5										
19		4				28/38						
20	18°	4		17/34		19/38	21/42	23/46	18/36	20/40	29/58	
	16°	4										
21		4					12/42					
22		4				3/33						
23		3						42/46				
24	15°	3							27/36	30/40		
25		3								24/40		
26		3					18/39					
27		3	9/27			11/33	13/39	14/42	12/36			
28		3						9/42				
29		3									6/58	
30	12°	3										
31		2		28/31								
33		2				24/33						
34		2		22/34								
35		2						24/42				
36	10°	2		17/34		19/38	21/42	23/46	18/36	20/40	29/58	
37		2								16/37		
38		2				14/38						
39		2					12/39					
40	9°	2							9/36	10/40		
41		2			8/41							

Number of parts	Division in degrees	Turns of Crank Handle: in full	in fractions								
42		2					6/42				
43		2			4/43						
45	8°	2									
46		1						44/46			
48		1								35/40	
50		1								32/40	
51		1		26/34							
	7°	1							27/36	30/40	
54		1		18/27		22/33	26/39	28/42	24/36		
55		1				21/33					
57		1				22/38					
58		1									32
60	6°	1		17/34		19/38	21/42	23/46	18/36	20/40	29
62		1		14/31							
63		1					18/42				
65		1					15/39				
66		1				12/33					
68		1		11/34							
69		1						14/46			
70		1					12/42				
72	5°	1							9/36	10/40	
74		1							8/37		
75		1								8/40	
76		1					7/38				
78		1					6/39				
80		1								5/40	
81		1							4/36		
82		1			4/41						
84		1					3/42				
85		1		2/34							
86		1			2/43						
87		1									2
90	4°	1									
92		—						45/46			
93		—		30/31							
95		—						36/38			
	3° 30'	—								35/40	
99		—				30/33					
100		—								36/40	
120	3°	—							27/36	30/40	
150		—								24/40	
180	2°	—		17/34	19/38	21/42	23/46		18/36	20/40	29
200		—								18/40	
240		—								15/40	
270		—	9/27			11/33	13/39	14/42	12/36		
300		—								12/40	
330		—				9/33					
360	1°	—							9/36	10/40	
	54'	—								9/40	
	48'	—								8/40	
	42'	—								7/40	
	36'	—								6/40	
	30'	—								5/40	
	24'	—								4/40	
	18'	—								3/40	
	12'	—								2/40	
	6'	—								1/40	
		—									

Pitch-diameter: 27, 31, 34, 41, 43 / 33, 38, 39, 42, 46 / 36, 37, 40, 58

The denominators of the fractions indicate the pitch-diameter: For instance: 6/27 = number of pitches / pitch-diameter

WORKING DIRECTIONS:

The table shows adjustments for simple divisions from 2—360 parts and divisions in degrees from 6'.—180 deg., using the indirect method of division.
Supposing an object has to be divided in 20 parts or in 18 deg. The table indicates: 4 17/34 or 4 19/38 turns of the crank handle. The index of the crank handle is set on the pitch circle 27 or 36. The crank handle is turned four full turns, and then 17 respectively 36 holes to the right or left.
To avoid errors in division, shears are provided on the division plate, which are set in such a manner, that one foot touches with its innerside at the index pin, while the other foot encompasses as many free holes to the right or the left, as the crank is supposed to be turned. Before each following division, the shears are turned again, up to the notch pin.
The division worm can be disengaged by turning the division plate to the left, after having loosened the tommy-screw.