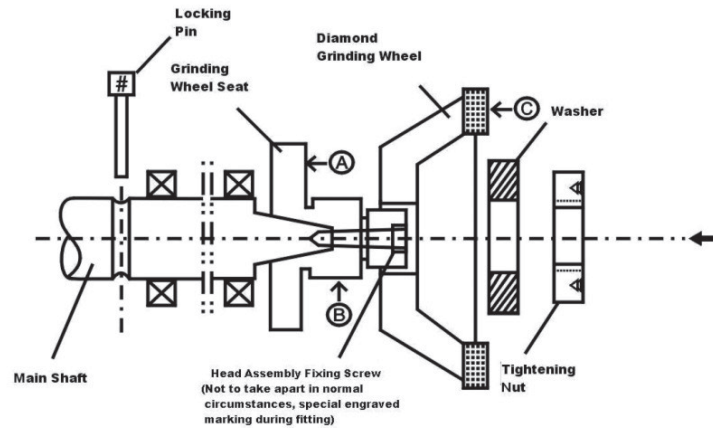
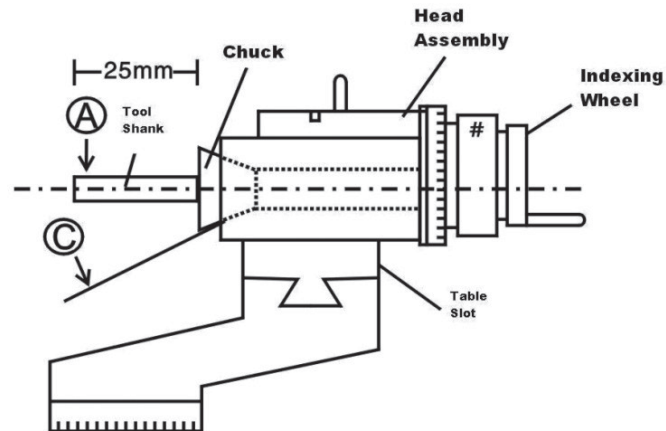


Ex-factory inspection records



Special Operation Instructions:

1. Calibrations before factory delivery: at (A) ____mm; and at (B) ____mm.
2. Assemble with reference to the diagram above by first inserting the Locking Pin, fit the Grinding Wheel, the Washer, and tighten the Tightening Nut with the special wrench provided with this machine. (Observe correct fitting and tightening of the Washer.)
3. The grinding wheel end surface at (C) is the grinding work surface and wobbling must be controlled at $\leq 0.03\text{mm}$.



Special Operation Instructions:

1. Wobbling at point (A) checked for \leq ____mm before factory delivery.
2. If (A) exceeds above stipulation during operation, take apart the Chuck and calibrate the inner conical surface of the Head Assembly to less than 0.02mm . If the Head Assembly is within acceptable limits, recheck Chuck and Tool Shank before operating.

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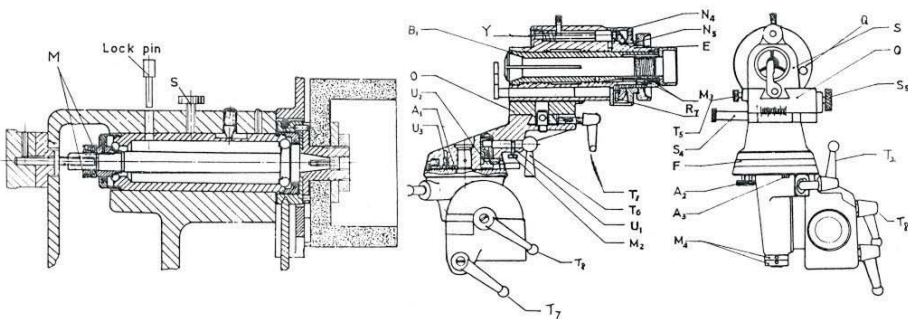
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Nomenclature of Controls

D	Wheel dressing attachment	S3	Index head slide
A	Spring collect clamping quill	O	white dot window
T1	Cross slide clamping lever	S5	Index head slide fine adjustment set screw
S2	Vertical swivel mount setting scale	S4	Index head slide fine adjustment screw
T2	Vertical swivel mount clamping lever	Q	Cross slide
T3	Horizontal swivel mount clamping lever	T6	Index drum F clamping lever
T4	Tubular guide clamping lever	B1	Collect sleeve
F	Horizontal swivel mount index drum	U2	Screw
T7	Clamping lever for adjustment along tubular guide	A1	Stop plate for 90 degree
H	Index head bracket fine adjustment screw	U3	Screw for A1
G	Adjustable stop screw	N4	Index drum
T5	Index head slide clamping lever	N5	Ring nut
C	Cutter lip aligning gauge	E	Index ring bearing sleeve
C1	Cross slide venires scale for off-center radii	M3	Nut for index sleeve
P	Spring collect index pin	R7	Slotted disc
A3	Adjusting eccentric pin	M4	Nut

GRINDING SPINDLE

The spindle bearing has been factory-adjusted to exclude play while allowing for a free-running spindle. In the event some play develops in the course of time, such play should be taken up by tightening the two nuts M. for this purpose, pull spindle from its seat after having loosened screw S and removed the parts as indicated in the illustration on page 15 and relighting R. When tightening the nuts allow for a forerunning spindle. Excessive tightening would result in bearing failure. After reinserting the spindle assembly carefully tightens screw S in the bore, to hold the spindle assembly in position.



Servicing the Index Head Bracket

General

After a major period of use it will be necessary to dismantle the index head bracket and to clean and lubricate the collect sleeve bearing, the index head slide, and the swivel arm.

Collets Sleeve Bearing

To remove the collect sleeve proceed as follows; Remove ring nut N5, index drum N4, and index ring R7, in that order. Remove two nuts M3 pull or out index bearing sleeve E. The annular grease chamber in the longitudinal slide L, which has thus been made accessible, should then be cleaned with petrol and refilled with tease.

Slide

Release clamping screw T5 and remove screw S5. Pull out index head slide S. Clean all working surfaces, smear lightly with oil, cross slide Q can not be removed. Release clamping screw T1 and turn screw S4 to move the cross slide to its extreme positions. Clean the bearing surfaces smear lightly with oil.

Swivel Arm

To remove the swivel arm and the index head as a unit remove the two nuts M4. Clean the bearing surfaces and smear them with oil.

Adjusting the Clamping Mechanism of Index Drum F.

After a major period of use clamping lever T6 should no longer lock swivel index drum F, screw U2 will have to be adjusted. For this purpose proceed as follows: Remove swivel arm as described above; remove screw U3 and stop plate A1; back off nut M2 and screw U1 and pull out clamping lever T6. Lift off index drum F to pull out adjusting nut and screw U2 rotate screw 180° relative to nut to reduce the length-to reassemble parts reverse procedure.

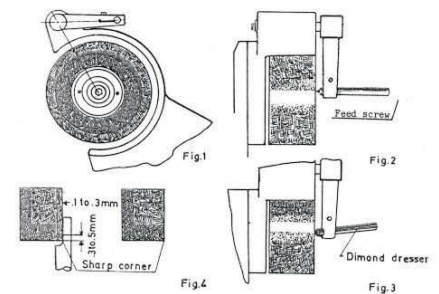
Adjusting the stop pin for the 90° swivel motion

If, due to constant striking of stop plate A1 against stop pin A2 and A3, the swivel range should no longer be exactly 90° correct the adjustment by turning the two eccentric stop pin A2 and A3. Turning stop pin A2 will change the cylindrical setting of the collect sleeve bearing, while turning stop pin A3 will adjust the 90° swivel motion.

Dressing the Grinding Wheel



Dressing the Grinding Wheel



Wheel Tiring and dressing should be performed at regular intervals. Dressing is done by means of a diamond set in a tip which is held in a rod. The latter is attached to an arm which is provided with a feed screw. The diamond tool assembly is supported by the wheel guard (see Fig. 1 and 2) wheel Tiring and dressing is particularly necessary when the wheel has become headed or when sharp corner has been worn off. Failure to comply with rule will result in poor surface finish and overheating of the cutting tools.

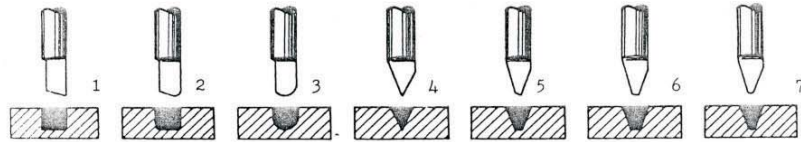
Messing:

1. Loosen clamping nut D. Shift dressing diamond to the right. Swing the dressing attachment in front of the wheel rim.
2. Set diamond, dresser 1 mm in front of the wheel. Lock clamping nut D.
3. Turn feed screw until the dressing diamond contacts the wheel. The layer to be dressed is 0.2mm. Give feed screw 1/5th turn.

Cutter Profiles–Tool Angle–Cutting Speeds

Cutter Profiles

As rule, single-lip milling cutters are given one of the seven basic profiles illustrated below:

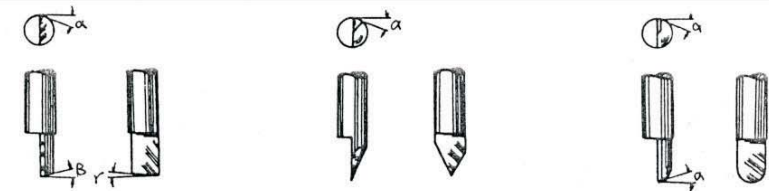


1. cylindrical, w/end relief
2. cylindrical, w/off-center radius
3. cylindrical, rounded off
4. pointed
5. tapered, w/end relief
6. tapered, w/off-center radius

Above are illustrated the seven basic cutter profiles and cross sectional views of the profiles they will produce

Material to be cut	Tool Angle α β γ	Recommended cutting speeds for high speed steelsingle lip cutter roughing cut finish cut			
		S.f.p.m	m/min	s.f.p.m	m/min
	25° 15° 5°				
Cast steel		195	60	260	80
Malleable cast iron					
Machinery steel					
57,000 to 85,000 (40to60kg/mm)		230	70	295	90
85,000 to115,000 (80kg/mm)		195	60	230	70
Over 115,000 (80kg/mm)		130	40	165	50

Material to be cut	Tool Angle α β γ	Recommended cutting speeds for high speed steelsingle lip cutter roughing cut finish cut			
		S.f.p.m	m/min	s.f.p.m	m/min
Tool steel soft grade hard grade		195 165	60 50	260 230	80 70
Brass, 58/41 soft Grade hard grade		655 820	200 250	820 1150	250 350
Brass,63/37soft grade Hard grade	30° 15° 5°	395 490	120 150	490 590	150 180
Bronze soft grade Hard grade	35°	525 655	260 200	655 755	220 230
Aluminum soft Grade hard grade		655 820 985	200 250 300	985 1150 1150	300 350 350
Wood	25° 15° 5°				
Plastic: Trogon	35°	820	250	985	300
Pertinaz,Fiber	45° 25° 20°	688	200	820	250
Astral on, Celluloid		655	200	985	300
Plexus		655	200	1150	350



Cutter with end relief. Cutter with pointed end. Rounded-off cutter

Tool Angles

As is the case with all metal cutting tools, single-lip milling cutters require the proper amount of cutting edge relief or back rake angle for maximum stock removal and high surface finish. As regards single-lip cutters, three different tools angles will have to be taken care of, these angles being used in all kinds of cutters.

Angle β applies to end relieved cutters only. Cutters having an angle of less than 20o should be relief ground at between 25o and 30o.

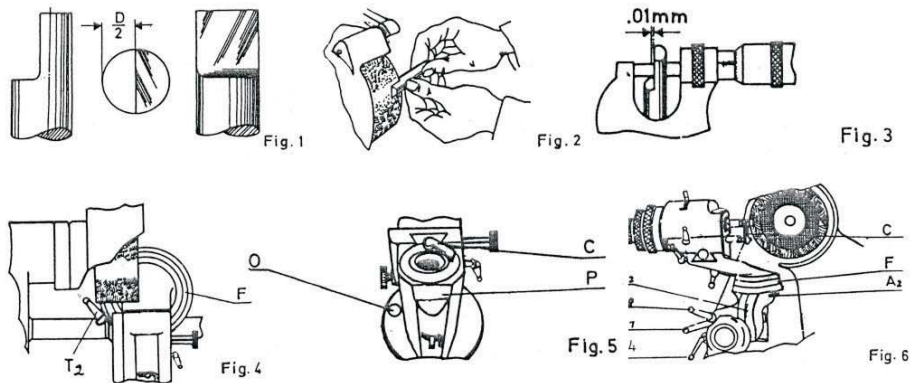
Cutter Speeds

As regards single-lip milling cutters, it is recommended to use cutting speeds three times higher than those used with standard type milling cutters. The data tabulated on the below should be used

as a guide only. As such factors as drive conditions and available spindle speeds will also have to be taken into consideration. In end cutting edges the cutting speed will decrease forwards the cutter. Center line. This effect is particularly noticeable in rode-off cutter. As a consequence, care should surfaces are concerned, rather than downward.

When cutting soft aluminium, use kerosene as a coolant. When cutting celluloid, the cutter must always be in feed motion, in order to avoid inflammation. tool angles and recommended cutting speeds for single-lipcutters

Tool angles recommended cutting speeds for single-lip cutters



Centering the Cutter Lip by Grinding

Cylindrical single-lip milling cutters are supplied by the manufacturer with the lip preformed by rough milling (see Fig. 1). As a result, the cutter lip will first have to be accurately centered by grinding. Rough grinding of the lip is performed manually by holding the cutter against the circumference of the grinding wheel (see Fig.2). This operation is followed by finish grinding in the machine. The off center tolerance is $\pm .0004$ "(0.01mm), which should be checked with a micrometer caliper (see Fig.3). To grind the cutter lip correctly, proceed as follows:

Setup Operations

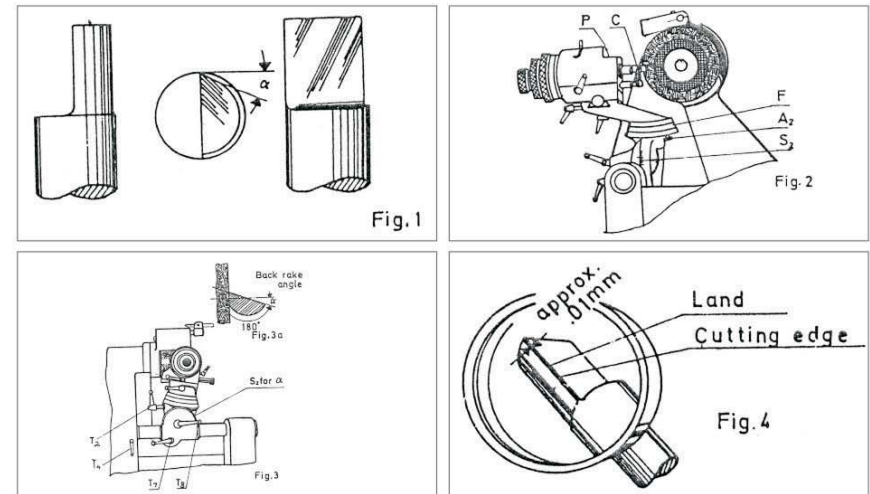
1. Set swivel arm and index drum F at zero, tighten clamping lever T3; set vertical setting scale S2 at zero, tighten clamping lever T2 (see Fig.4).
2. Set cutter with aligning gauge C clamp cutter in position, rectum aligning gauge C (see Fig.6).
3. Withdraw index pin Prostate spring collect bearing 180o, allow index pin P to engage the short-slot.
4. Shift index head bracket along tubular guide to bring cutter lip into light contact with end face of grinding wheel. Be sure prior to tightening clamping lever T7, to align vertical swivel mount index mark with tubular guide. Tighten clamping lever T7, release clamping lever T4.

Centering the Cutter Lip

6. Fine adjustment screw H serves to set the index head accurately relative to the wheel and to provide the desired depth of cut. The travel of the cutter past the wheel can be limited by means of adjustable stop screw G. Thus it is possible, during priding to advance the cutter as far as it will go. To bring the cutter lip within the prescribed off-center tolerance, reciprocate the index head bracket while advancing the cutter by rotation fine adjustment screw H.

In order to prevent the cutter from being overheated, it is recommended to leave only a narrow cutting zone on the grinding wheel (see page 5 "Dressing the Grinding Wheel"). The length of the cutter lip should equal one and one half times the diameter of the cutter.

It is not advisable to increase the length of the cutter lip beyond a certain limit. In the case of deep engraving work where stepped cutter is used the shank of the cutter will be increased instead of the lip.



Circular Grinding of Cutters- Grinding the Back Angle of Side Cutting Edges

After centering the lip it will be necessary to grind the back rake angles of both the side cutting edge and the end cutting edge. The back rake angles of both cutting edges should be selected to suit the material to be cut.

Setup Operations

1. Rotate swivel arm to set index F at zero; tighten clamping lever T3.
2. Bring white dot into window Unengaged index pin P into long slot.
3. Align cutter by means of gauge C; grip cutter in position return gauge C (see Fig.2).
4. Release clamping lever T2;set swivel arm at desired back rake angle using setting scale S2;tighten clamping lever T2 (see Fig.3).

5. Tighten clamping lever T4; release clamping lever T7; shift work fixture on tubular guide to bring cutter into light contact with grinding wheel, tighten clamping lever T7; release clamping lever T4.

Circular Grinding

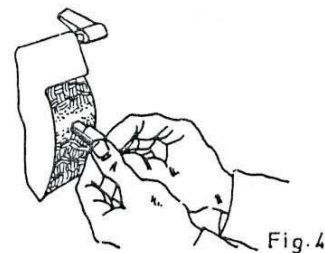
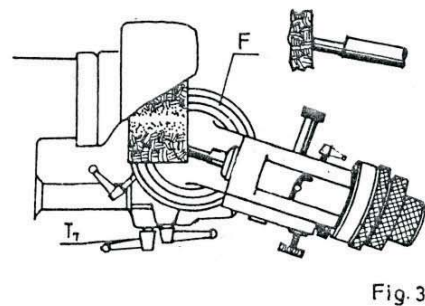
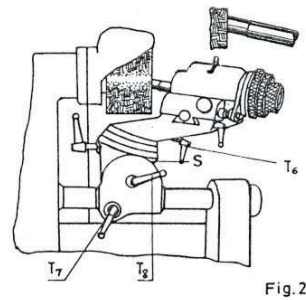
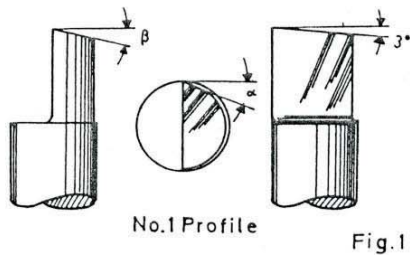
6. Draw index pin P out of the slot; grind desired diameter by rotating spring collets bearing through 360°. During this operation slowly rotate adjustable stop screw G, while continuously rotating the spring collets bearing, to advance the work fixture past the grinding wheel; this will produce uniform stock removal. Fine adjustment during circular grinding is by screw H. Stop screw G is used to establish the length of the cylindrical portion which should always be slightly longer than the cutting lip.

7. Return white dot into window Unengaged index pin P into short slot to enable bearing to be rotate 180° between the index plate stops.

Grinding the Back Rake Angle

8. When grinding the back rake angle, use the fine adjustment screw H over the entire range of rotation of the collets bearing (see Fig.3a). Grinding of the back rake angle is positive controlled. The angle is required to extend over the entire length of the cutting lip.

The vertical swivel bearing, which permits the work holding fixture to be swung back, enables relief angles up to 40° to be produced. Relief angles over 40° can be obtained by additionally rotating the collets bearing in the index head. (Only for cylindrical or tapered cutter with straight end cutting edges or for pointed cutters.) Upon completion of grinding operations a very narrow land must remain at the cutting edge (see Fig.4).



Circular Grinding of Cutters— Grinding the Back Angle of End Cutting Edges

The end cutting edge illustrated in Fig. 1 may be ground in an operation immediately following the grinding of the side cutting edge; or it may be ground independently. In the latter case the cutter will have to be aligned by means of gauge Cad clamped in position. Whenever a single-lip cutter is to be ground, the aligning will have to be used, as one leg of the cutting angle should be selected to suit the material to be cut. (See page 5)

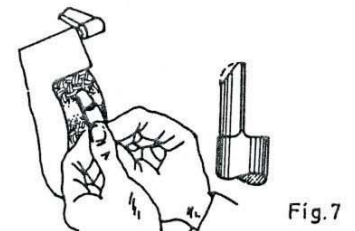
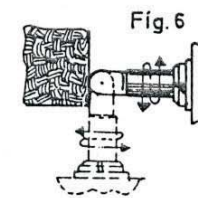
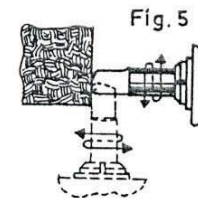
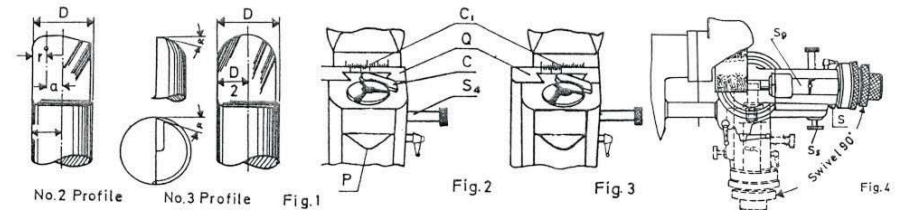
Setup Operations

1. Release clamping levers T2; using setting scale S2, set swivel arm at approx. 30°; tighten clamping lever T2.
2. At desired angle; for example set arm at 75° for back angle of 15° (see Fig.2 and Fig.3). Tighten clamping lever T3 and T6.

3. Tighten clamping lever T4; release lever T7; shift work fixture on tubular guide to bring cutter into light contact with grinding wheel tighten clamping lever T7; release lever T4.

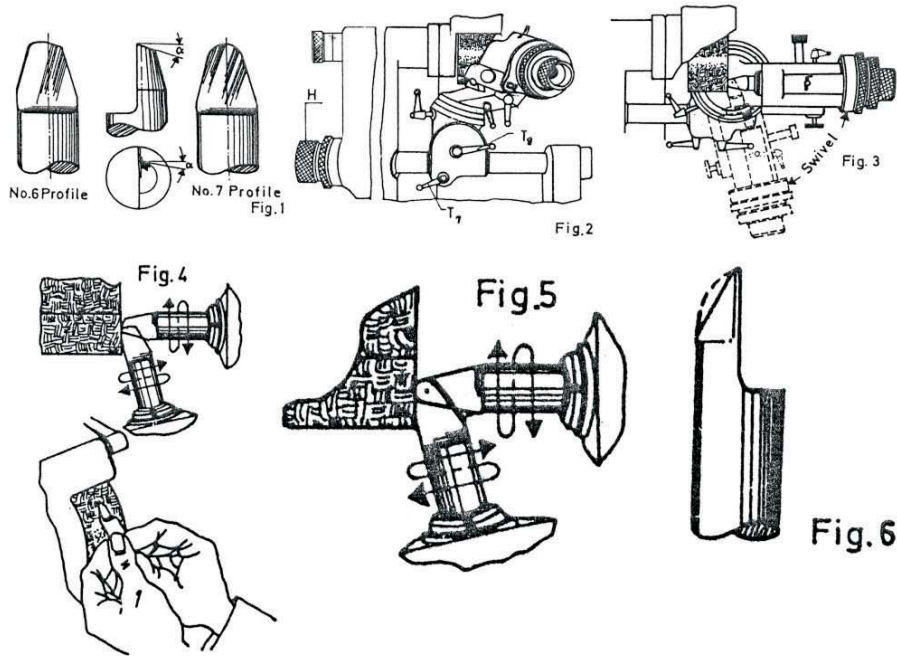
Grinding the Back Rake Angle

4. Fine adjustment screw H serves to set the index head laterally reactive to the wheel and to set the work for the desired depth of cut. It is also possible to produce the desired back rake by holding the cutter against the circumference of the grinding wheel as is shown in Fig.4.



Circular Grinding of Cutters – Grinding the Back Angle of End Cutting Edges (Round)

Cutter profiles having either on-center or off-center radii are derived from cylindrical single-lip cutters having a straight end cutting edge by rounding off the corner as shown in Fig.1 (No.2 and 3 profiles).



Grinding Tapered Cutters– Grinding the Back Rake Angle of Side and End Cutting Edges (Round)

Tapered cutters having either an off-center or an on-center radius can be given a back rake angle only in connection with their circular grinding operation (see Fig. 1). The back rake angle of the side cutting edge equals that of the straight or coded end cutting edge; the proper angle to be used will be found in page 5. After tapered cutters with rounded end cutting edges have become dull, first proceed with the circular grinding operation described on page 12; then follow the procedure indicated below.

Setup Operations

1. Release clamping lever T2; use scale S2 to set work fixture at desired back rake angle; tighten clamping lever T2. Tighten clamping lever T4; release lever T7; shift work fixture along tubular guide to bring cutter into light contact
2. with grinding wheel; tighten clamping lever T7, taking care to keep index mark of vertical swivel mount aligned with tubular guide; release clamping lever T4. (see Fig. 2)

Grinding the Back Rake Angle

3. While continuously rotating the collets bearing through 180 (back and forth between the stops), advance the cutter towards the grinding wheel by means of fine adjustment screw H. This will produce the desired back rake angle on both side and the end cutting edges in a positively controlled operation (see Fig. 3, 4, 5).

Upon completion of grinding operations, a very narrow land must remain at the cutting edge. In cases where the cutter is intended for the machining of hard steel which requires a small back rake angle, it is

4. Advisable to grind off part of the curvature in a manual operation (see Fig. 6).

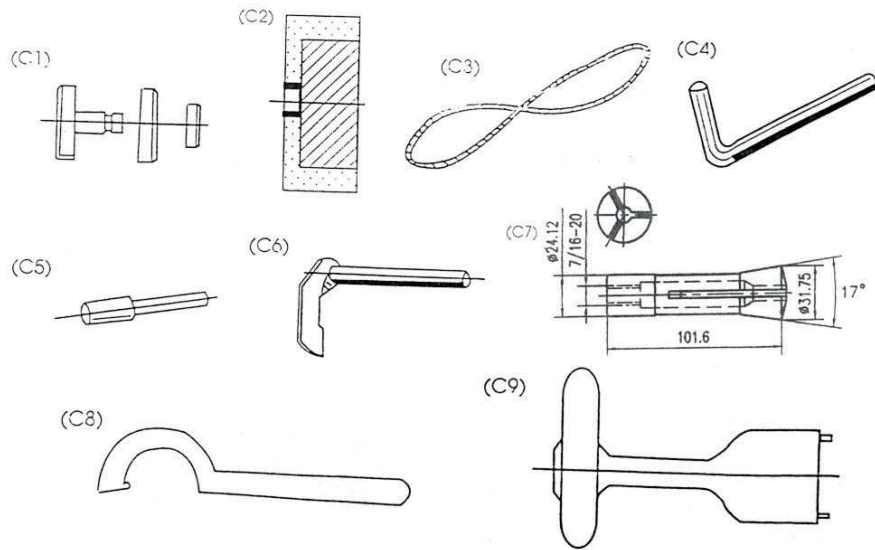
In addition it is recommended, with regard to all single lip cutters, to whet also the cutting lip by means of an oil stone in order to remove burrs. However, care should be exercised not to remove noticeable amount of stock from the cutting lip, as this would destroy the centering of the lip; moreover, this would render a greater or lesser part of it useless.



ACCESSORIES

STANDARD EQUIPMENT			
1. Wheel dresser with diamond	1	14. Wheel mount (Flange) (C1)	1
2. Diamond pen	1	15. Wheel lock pin (C5)	1
3. Wheel mount (Flange) (C1)	1	16. Spring collets (C7) 4, 6, 8, 10, 12	5
4. Driving belt (C3)	1	17. Wheel spanner (C9)	1
5. Wheel lock pin (C5)	1		
6. Machine light	1		
7. Hex socket screw wrench (C4)	4	SPECIAL ACCESSORIES (ON EMEND)	
8. Aligning finger (C6)	1	1. Diamond wheel for grinding carbide cutter	
9. Operating Instructions	1	2. Balance stand and arbor	
10. Twist drill grinding attachment	1	3. Special index head slide with clamping sleeves for grinding dial, 20, 25mm cutter	
11. End mill grinding attachment	1	4. R8 collets: 3, 4, 5, 6, 8, 9, 10, 12, 14, 16, 18, 20, 22, 25, Φ 1/8", 11/64", 3/16", 1/4", 5/16", 3/8", 1/2", 5/8", 3/4", 1"	
12. Lathe tools grinding attachment	1	5. Driving belt.	
13. High-speed cutter grinding wheel 100x25x20 100K (C2)	1	6. Curved hook spanner (C8)	

Standard accessory are subject to change without notice.



Twist Drill Grinding Attachment

The twist drill grinding attachment has been designed for grinding twist drills of 3 to 18 mm (1/8" to 11/16") diameter. The lip angle is always 116, while the back rake angle is adjustable as required.

To mount the attachment (see Fig.2), attach a 12 mm (1/2") spring collets to locating pin 1 and insert the collets into the index head slide of the index head bracket, introducing retaining pin 2 into the bore of the off-side setting gauge. Adjustable stop 5 has a flat furnace on one side for holding twist drills of 3 to 18mm (1/8" to 11/16") diameter. The drill is held by hand against stop 5 and the swivel-mounted V-guide 4 during grinding (Fig.1). After backing off clamping screw 7, stop 5 with ring 999 can be pulled off (depress catch 10) and mounted in reverse position. This permits clamping of small drills (3 to 6mm or 1/8" to 1/4" dia.) By means of clamping screw 6, since experience has shown that such drills are difficult to hold by hand grinding.

Setup Operations

1. Release clamps K3 and K4. Hold index drum T4 against stop by means of the knob and set swivel arm at 13. Retighten clamps K3 and K4.
2. Release clamp K2 and set swivel arm at zero on setting scale T2 (resulting in a normally suitable rake angle). If larger or smaller rake angles are required, adjust swivel arm accordingly. Retighten clamp K2. Release clamp K6 and screw D6. Move index head slide T until its front face roughly coincides with the front face
3. of cross slide Q. Retighten clamp K6 and screw D6. Only if new grinding wheel is used :
4. Release clamp K5, move cross slide Q fully to the right using knurled screw S5. Retighten clamp K5. Release clamp 3 (on attachment) and adjust swivel-mounted V-guide 4 until the scale

shows the diameter of the twist

5. Drill to be ground. Retighten clamp 3. Release clamp K1, tighten clamp K. Move index head bracket on the tubular guide until gauge plate 8 is position

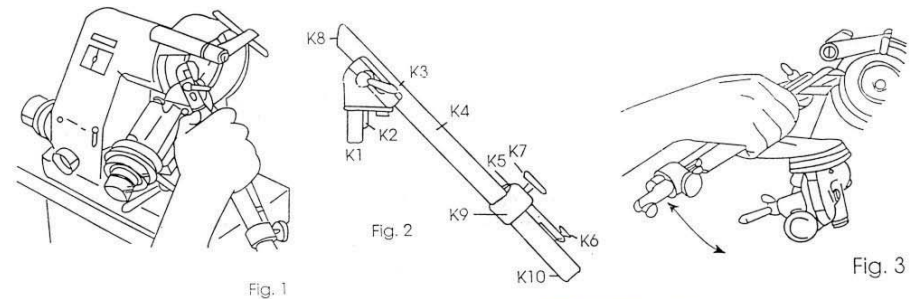
6. approx. .04" (laterally of the face of the grinding wheel. Align vertical swivel mount index mark with reference line of tubular guide, then retighten clamp K1 and release clamp K. Place the drill on V-guide 4. Back off clamping screw 7 and advance stop 5 until the cutting face of the drill rests

7. Against gauge plate 8, projecting approx. 0.02" (.5mm) Tighten clamping screw 7. When using the adjustable stop in reverse position (for small twist drills of 3 to 6mm 1/8" to 1/4" dia.), tighten clamping screw 6.

Setup Operations

8. Swivel twist drill grinding attachment upwards. Use fine adjustment screw F to advance the drill until it contacts the grinding wheel. Grinding first cutting edge by swiveling the attachment downwards (Fig.3). Repeat feed and grinding operation if required.

9. Place twist drill into V-guide 4 in 180 inverted position and grind second cutting edge leaving the attachment and the adjustable stop in the previously used position (i.e. not advancing fine adjustment screw F.)



INSTRUCTION FOR GRINDING END MILL

Change the original work head into End mill attachment work head. (As drawing I)

Insert the suitable size U2 collets into the tapered hole of the end mill attachment work head.

Insert the end mill into the U2 collets and faster it, So that the end mill will not turn. (as drawing II)

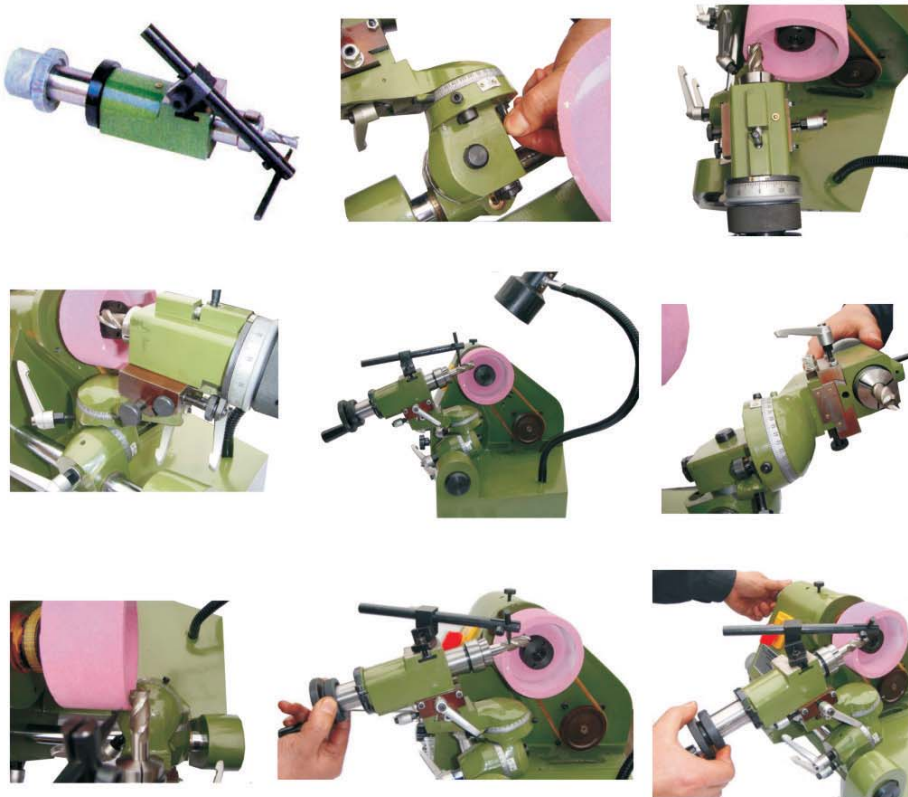
Set the center of the wheel head at the height of the work head spindle center and locate the end mill top leaving about 5mm from grinding wheel (as drawing III)

Swiping the end mill attachment work head by the degree of relief angle.

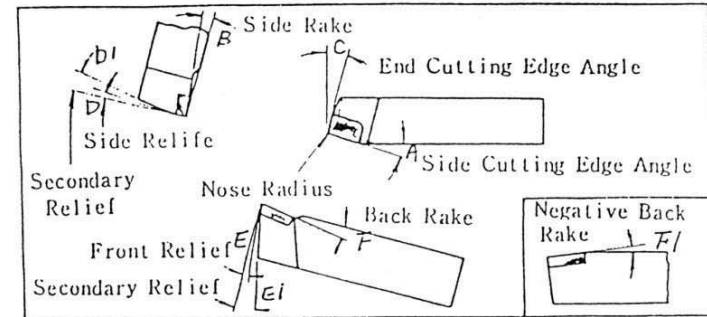
Use the grinding guide pin to grinding the rake of end mill following the screw of end mill by the direction from front to back. (as drawing IV)

To grinding the secondary relief angle when the primary relief angle grinding is finished ake the grinding guide pin into the screw groove of secondary rake then grinding same as first rake.

Swivel the end mill grinding attachment horizontally by 90 degree then according the degree of end cutting edge angle of end mill for grinding the rake of the top angle of end mill. (As drawing IV)



INSTRUCTION FOR GRINDING A LATHE TOOL BIT



Change the original work head into Lathe tool attachment work head. (As drawing I)

Insert the Lather tool bit into the Lathe tool attachment work head and fasten it, so that the Lathe tool bit will not move.

Set the center of Lathe grinding attachment at the height of the grinding wheel of the spindle center. (As drawing II)

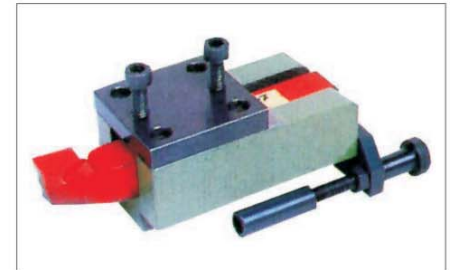
Swivel the lathe tool grinding attachment horizontally by the degree of side cutting edge angle for grinding side cutting edge angel (A), Fix the angle the horizontal angle A then swivel the lathe tool grinding attachment vertically by the degree of side rake angle (B) for grinding side rake angle (as drawing III)

Swivel the lathe tool grinding attachment horizontally by the degree of and cutting edge angle for grinding end cutting edge angel C), then fix angle for grinding end cutting edge angel ©

The horizontal angle at angle A then swivel the lathe tool grinding attachment vertically by the degree of side relief angle (D) & secondary relief (D1) (as drawing IV)

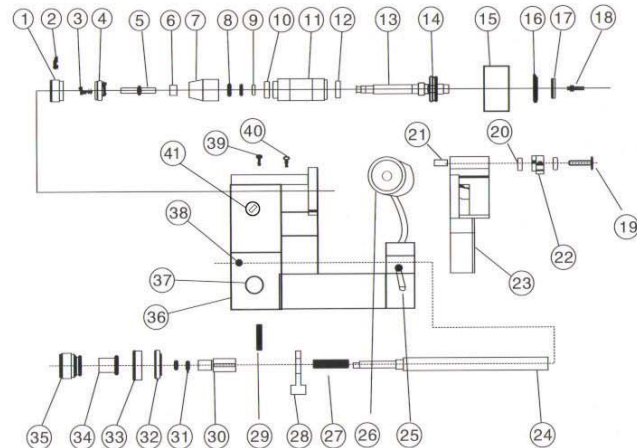
Swivel the lathe tool grinding attachment horizontally by the degree at original position then swivel the lathe tool grinding attachment vertically by the degree of front relief (E) and second relief (E2)

Change the lathe tool bit by top-side face the grinding wheel, swivel the lathe tool grinding attachment horizontally by the degree of back angle negative back rake angle for grinding for grinding back rake (F) or negative back rake (F2)



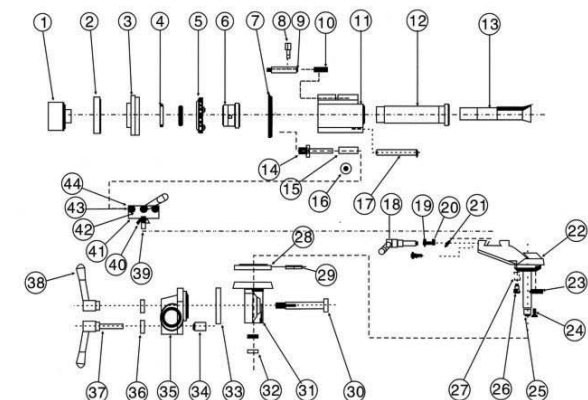
Main Seat

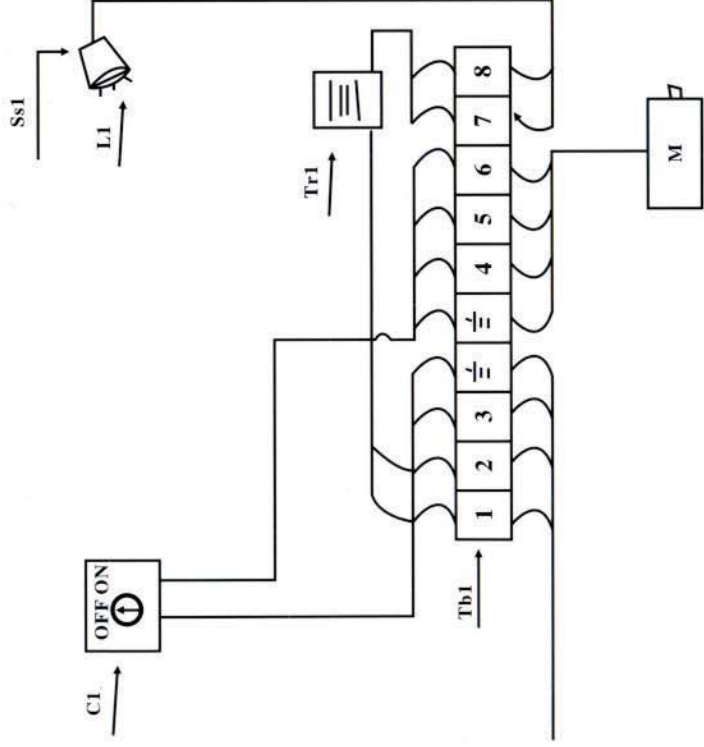
Index No.	Parts Name	QTY.	Index No.	Parts Name	QTY.
1	Feed the handwheel	1	22	Diamond pen clamping pole	1
2	Tight set screw	2	23	Grinding wheel cover	1
3	screws	3	24	axis	1
4	In the above calibration rings seats	1	25	Could be modulated attacked his	1
5	Adjustment screw	1	26	Working lamp	1
6	Copper set	1	27	spring	1
7	Spindle cover	1	28	Swinging regulation pole	1
8	Adjustment nut	1	29	Tensile spring	1
9	gasket	1	30	Adjustment screw	1
10	bearing	1	31	Adjustment nut	1
11	collar	1	32	Below in the calibration rings seats	1
12	bearing	1	33	The following calibration rings	1
13	spindle	1	34	Adjusting collar	1
14	Spindle pulley	1	35	Feeding the handwheel under	1
15	Grinding wheel	1	36	Machine shell	1
16	Grinding wheel gasket	1	37	The five-star hand	1
17	Grinding wheel nut	1	38	screws	1
18	Remove screw	2	39	screws	1
19	Trim device shaft	1	40	screws	1
20	bearing	1	41	switch	1
21	Adjustment nut	1			



Turning Seat Attachment

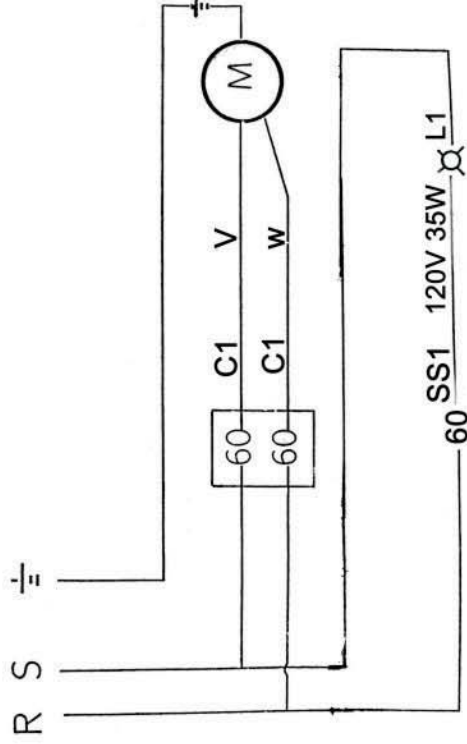
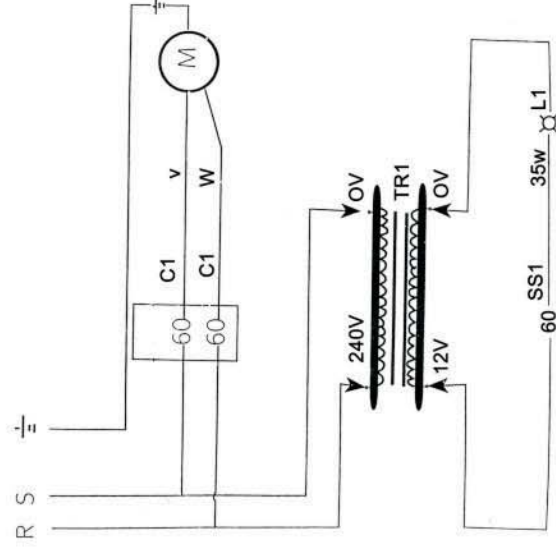
Index No.	Parts Name	QTY.	Index No.	Parts Name	QTY.
1	Collect Hand tightening	1	23	Linking piece screws	1
2	Dividing head nut	1	24	Connection screw	1
3	360 ° calibration rings	1	25	axis	1
4	Adjustment nut	1	26	Stop moving set screw	1
5	Indexing tooth	1	27	Stop moving set	1
6	Indexing set of	1	28	Horizontally rotating calibration ri	1
7	Retaining plate	1	29	Fastening screw	1
8	Stop moving screws	1	30	Stop moving screws	1
9	Compression spring	1	31	Rotating seats 2	1
10	Chuck seat	1	32	Adjustable nut	1
11	Collect set of	1	33	40 ° calibration rings	1
12	Collect	1	34	Stop moving set of	1
13	Adjustment screws	1	35	Rotating seats 1	1
14	Adjust lever	1	36	gasket	1
15	Stop moving screws	1	37	Adjustable hand	1
16	For tool rod	1	38	Adjustable hand	1
17	Adjustable hand	1	39	Fastening screw	1
18	Adjustable nut	1	40	Adjustable nut	1
19	Adjustment screws	1	41	Sliding block	1
20	Copper plug	1	42	Adjustable hand	1
21	Rotating seats	1	43	Adjustable nut	1
22	Linking piece	1	44	Adjustment screws	1





C1	Starar
Tb1	Transformer
Ss1	on-off Light
L1	Light
Tr1	power Fallure
M	Motor

Circuit Diagram



(V/ HZ)

(V/ HZ)