RECORD MACHINE DETAILS	DISTRIBUTOR
MODEL	
SERIAL NO.	
DATE OF PURCHASE	
VOLTAGE	
PHASE	
CYCLES	
QUOTE THIS INFORMATION WHEN REQUESTING SERVICE OR SPARES	

This Bandsaw is engineered to a high standard of construction and performance. Attention to maintenance and service will be repaid by meny years' of trouble-free operating.

STARTRITE

216-316 series

BANDSAWING MACHINES

HANDBOOK

6E

FOR CUSTOMER SERVICE, SALES & ACCOUNTS

A.L.T. Saws & Spares Ltd
Startrite Machine Specialist
Unit 15, Pier Road Industrial Estate
Gillingham
Kent
ME7 1RZ
Tel/Fax: 01634 850833
www.altsawsandspares.co.uk

SPECIFICATION :

Model 216 - 316 Series	-	216/216H : 15½" Throat, 2 Wheel, Infinitely Variable Speed Machine. 316/316H : 36¼" Throat, 3 Wheel, Infinitely Variable Speed Machine.
Wheel Diameter	-	405 mm, 16"
Motor	-	2.2 kW., 3 h.p., 940 r.p.m.
Electric Supply	-	220/240 Volt 3 Phase 50Hz. 380/440 Volt 3 Phase 50Hz.
Blade Lengths	-	216/216H : 3530 mm, 139" 316/316H : 3530 mm, 139" & 4625 mm, 182"
Max. Blade Width	-	25 mm, 1"
Max. Distributed Static Table Load	-	227 kg., 500 lbs.
Gross Weights	-	216/216H : 635 kg., 1400 lbs. 316/316H : 771 kg., 1700 lbs.

FOR SPARE PARTS & BLADES CONTACT A.L.T. SAWS & SPARES LTD

WHEN ORDERING PARTS, PLEASE STATE :-

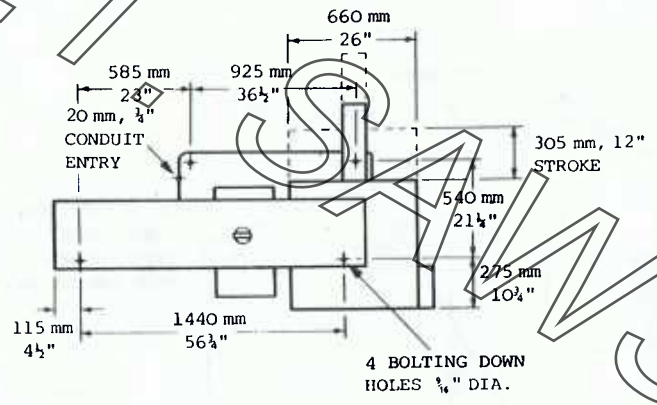
1. Quantity required.
2. Part No. (where applicable) and description.
   Specify power supply for electrical components.
3. Machine Model and Serial No.

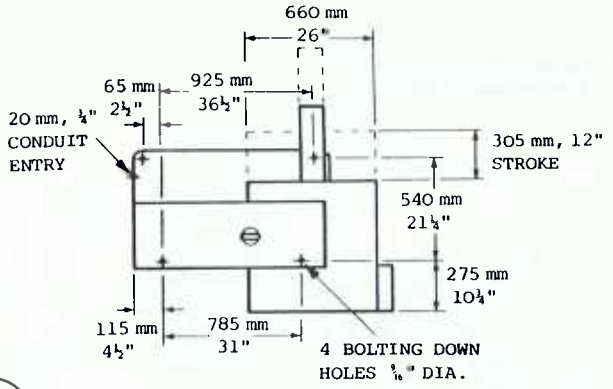
6E

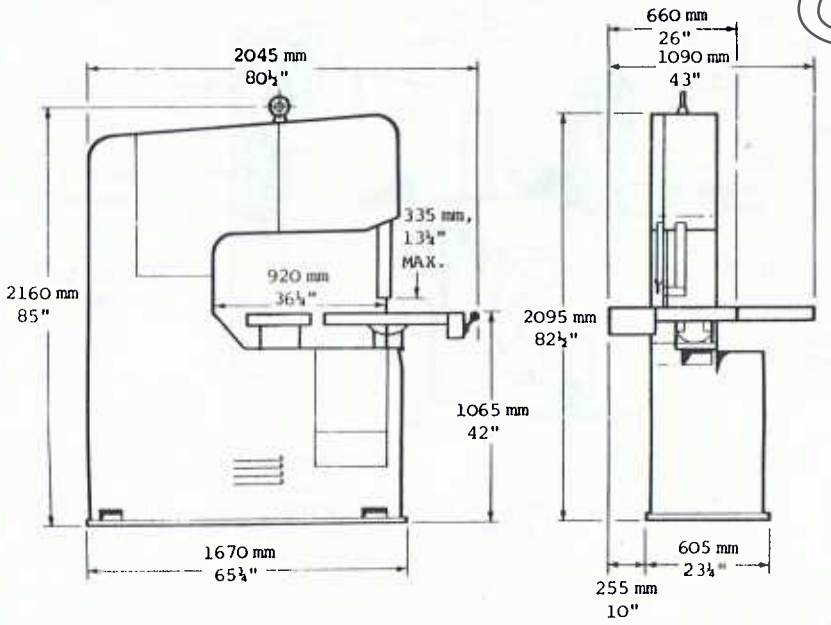
NOTE : ILLUSTRATIONS MAY VARY IN DETAIL, ACCORDING TO MODEL.

Startrite Machine Tool Co. Ltd., Waterside Works, Gads Hill,
Gillingham, Kent, ME7 2SF, England.

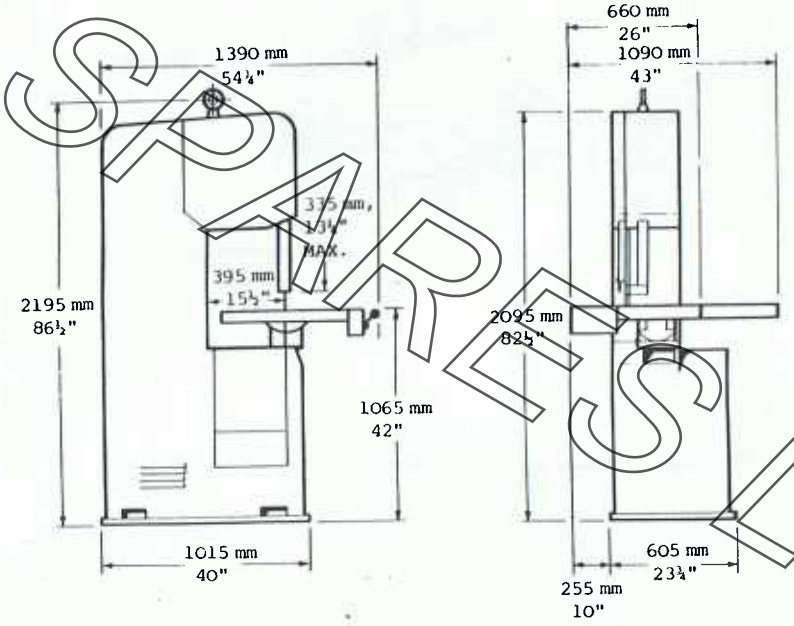
ALL DIMENSIONS APPROXIMATE.



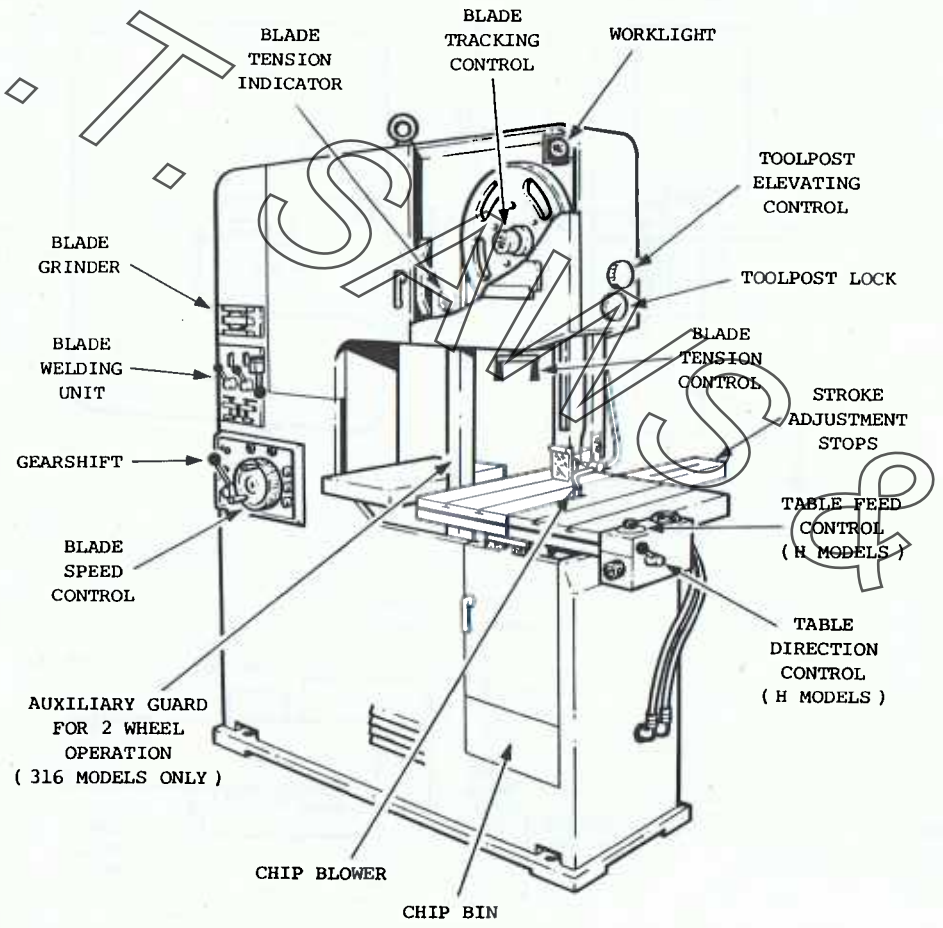


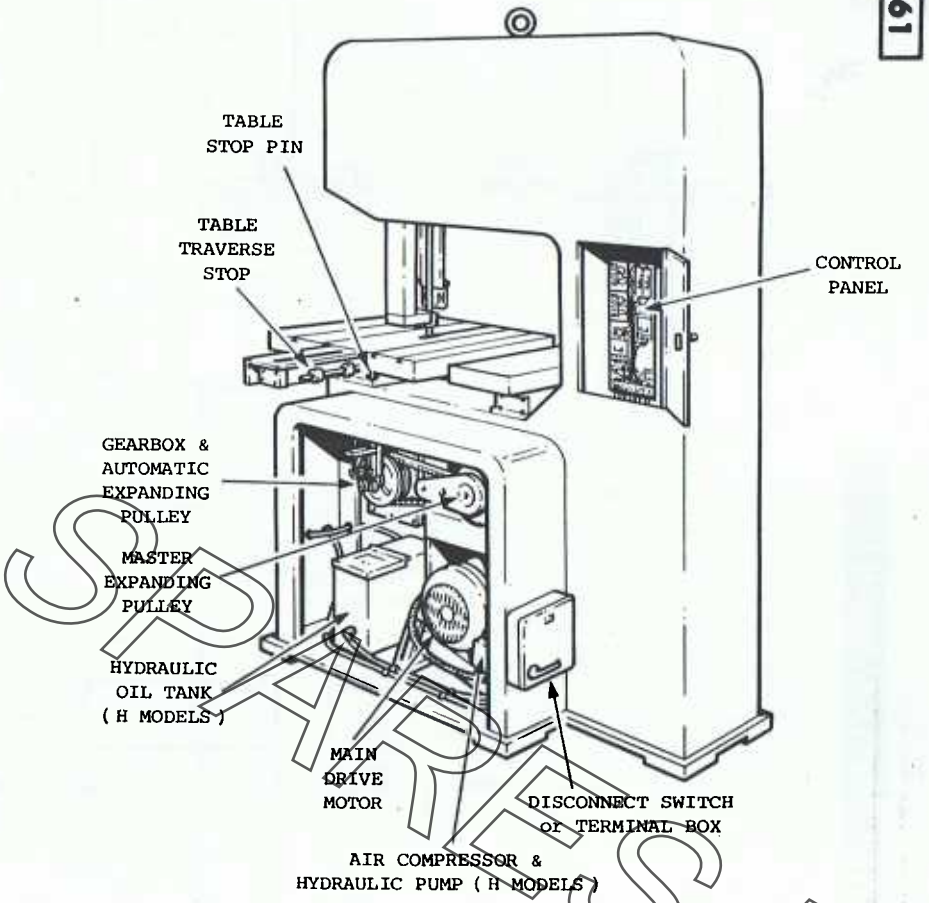


FOUNDATION PLAN FOR 316-316H SERIES BANDSAWING MACHINES.
(DETAILS VARY ACCORDING TO MODEL)



FOUNDATION PLAN FOR 216-216H SERIES BANDSAWING MACHINES.
(DETAILS VARY ACCORDING TO MODEL)





GENERAL LAYOUT OF 216-316 SERIES BANDSAWING MACHINES.
(DETAILS VARY ACCORDING TO MODEL)

OPERATING SAFETY PRECAUTIONS.

Before attempting to operate machine, become familiar with the controls and operating instructions.

Do not start machine unless all guards are in place, keep guards in place when sawing.

Check that table direction control lever is at STOP position before starting machine (Machines fitted with Hydraulics).

Adjust and secure table before loading workpiece. (Do not exceed the maximum table load).

Position the top guides as close as possible to the workpiece.

Hold small or unstable workpieces by means of a clamp or other device. Keep hands clear of the saw blade at all times.

Keep the work area free of tools and off-cuts.

Stop the machine to make adjustments.

Stop the machine before leaving it unattended.

Wear eye protection.

Use care in uncoiling and installing new saw blades as the teeth are very sharp. It is advisable to wear gloves when handling saw blades.

Do not leave saw blades on the floor.

Machining some materials may create a hazard to health in the form of fumes, dust or the risk of fire or explosion. In such cases it is imperative that expert advice is obtained on the correct handling of such materials, and the fitting of additional equipment to the machine in order to achieve the required standard of safety.

INSTALLATION.

To transport the machine to site, a lifting eyebolt is supplied with the machine, and this must be screwed into the top of the machine body to provide a balanced and secure lifting point.

WARNING : The use of slings around the machine body is not recommended and on no account must the table or its mounting mechanism be used as a sling attachment point when positioning the machine.

Adequate working and job lay off space is essential to efficient operation, so do not site the machine in a cramped position in the workshop. Bandsaw blades tend to get tangled and damaged if hung from a hook or stacked on the floor, therefore cupboard space provided adjacent to the machine will protect saw blades in storage and encourage the operator to select a suitable saw blade for the job.
The base of the machine is provided with four fixing holes (see page 1 for appropriate dimensions) to accept ½" diameter anchor bolts (not supplied),

INSTALLATION (CONTINUED).

but the machine may be fixed in position with resilient mounting pads secured by adhesive in order to avoid damage to the floor. Where necessary, the floor must be levelled so that the machine stands with equal firmness at all fixing points.
Remove the anti-rust protective coating where applied, and in particular from the working elements of the machine.

SLIDING TABLE :

Soak the table slideway wipers with oil.

IMPORTANT : The table slideway rollers and bearings are pre-loaded and adjusted for correct alignment. On no account should this setting be tampered with before the correct method of adjustment and re-assembly is fully understood, see Section on Manual Feed (Parts Lists & Illustrations).

If the machine has been shipped with the table as a separate item, re-assemble table to machine in the following manner :-

1. Place the intermediate cradle level upon the lower cradle with the slotted lug to the left hand side as seen from the operating position.
2. Lift the table into position allowing the trunnion to seat and the ¾" diameter bolt to pass through the slots in both cradles. Where necessary, the bolt may be assembled into the trunnion by passing it through the table insert aperture.
3. From the underside of the cradle platform, assemble in bolt on order :-
   Spring Housing, spigot end first.
   Spring, into body of housing.
   Washer, plain face first.
   Nut, using wrench supplied.

MACHINES FITTED WITH HYDRAULIC SYSTEM :

216H and 316H machines require to have two hydraulic pipes connected from the control box to the pipe fittings at the side of the machine. Do not fill hydraulic tank until after connection to the electricity supply.

MACHINES FITTED WITH AIR/SPRAY COOLANT SYSTEM :

Do not fill coolant tank until after connection to the electricity supply.

CONNECTION TO THE ELECTRICITY SUPPLY.

Before connecting to the electricity supply, see Section on Electrical System for full instructions.

TRANSMISSION :

IMPORTANT : Lubricate expanding drive pulley shafts, see page 6. Start motor and operate the speed control dial at the front of the machine to the full extent of its range in each direction. Repeat several times to disperse grease over shaft serrations.

IMPORTANT : OPERATE SPEED CONTROL DIAL ONLY WHEN MOTOR IS RUNNING.

HYDRAULIC SYSTEM (WHERE FITTED) :

Fill hydraulic oil tank (216H and 316H Models Only) with recommended grade of hydraulic oil :-
ESSO Nuto H44 ; GULF Harmony 43AW ; MOBIL D.T.E. 24 ; TEXACO Rando HDA :
Start machine and check pipe fittings for leaks. When the machine has been running for approximately ten minutes, shift table control lever to 'TRAVERSE' and check pressure gage reading when the table has travelled the full extent of its stroke. If necessary, slacken knob at the front of the control box and turn the slotted screw to give an indicated pressure reading of 100 - 105 P.S.I., re-locking knob after adjustment.
Set table feed control to maximum (mark 20) and operate the hydraulic table in each direction to the full extent of its stroke to disperse air locks so that the table moves with a smooth uniform motion.
The table must travel in the direction indicated by the operating lever or it will be impossible to obtain fine feed control on the forward stroke. Where this is the case, the two flexible hydraulic pipes from the control box must be interchanged at the point where they are fitted to the machine body.

AIR/SPRAY COOLANT SYSTEM (WHERE FITTED) :

Fill coolant tank with diluted STARCOOL cutting oil, see Section on Optional Extra Equipment for full instructions.

IMPORTANT : COOLANT IN THE TANK MUST BE KEPT ABOVE THE LEVEL OF THE FILTER. THE FILTER SHOULD NOT BE ALLOWED TO BECOME EXPOSED TO THE ATMOSPHERE.

CAUTION : DILUTED STARCOOL SOLUBLE CUTTING OIL IS THE ONLY RECOMMENDED COOLANT. USE OF OTHER OILS MAY CAUSE DIFFICULTIES IN OPERATION AND IN SOME CASES, DAMAGE TO PARTS OF THE MACHINE.

SETTING UP THE MACHINE.

For full instructions on how to set up the machine for correct use, see Section on Setting Up The Machine / Blade Guides.

MACHINE CONTROLS.

BLADE SPEED CONTROL :

Operation of the gearshift lever at the front of the machine selects a low speed range of 50 - 360 feet per minute (15 - 110 meters per minute), or a high speed range of 500 - 3600 feet per minute (150 - 1100 meters per minute).

IMPORTANT : DO NOT SHIFT GEAR WHEN MOTOR IS RUNNING.
SHIFTING GEAR WHEN MOTOR IS RUNNING WILL DAMAGE GEARBOX.

The motor can be jogged to facilitate engaging gear, but allow motor to stop before operating gearshift lever.

Variation of saw speed in each range is controlled by the speed selector dial at the front of the machine.

IMPORTANT : OPERATE SPEED CONTROL DIAL ONLY WHEN MOTOR IS RUNNING. TURNING SPEED CONTROL DIAL WITH MOTOR STOPPED WILL DAMAGE VARIABLE SPEED DRIVE.

SECTION 61

MACHINE CONTROLS (CONTINUED).

BLADE SPEED CONTROL (CONTINUED) :

The red scale on the dial indicates saw speed in low gear (red signal light on), and the amber scale indicates saw speed in high gear (amber signal light on).

Speed compensation for variation in material thickness is achieved by aligning the name of the material (or its cutting speed) on the speed selector scale with its indicated thickness on the adjacent panel scale.

EXAMPLE :-
Mild steel of 1" (25 mm) thickness would be sawed at 180 feet per minute (55 meters per minute) as indicated on the red scale, but a 4" (100 mm) thickness would be sawed with the 'Mild Steel' on the selector scale aligned with the '4' mark on the panel scale, thereby setting the cutting speed at 140 feet per minute (43 meters per minute).

Although the scales provide a reliable instant guide for sawing many combinations of material and thickness, see Section on Sawing Practice - Saw & Speed Selection Charts, for more detailed information.

SLIDING TABLE :

The table is secured in position by a single bolt passing through the tilting cradles with the locking nut accessible through the opening beneath the table mounting. Slackening the nut about one half turn will allow the table to be tilted up to 45° to the right. The table will also tilt 15° to the left, 5° forwards or 5° backwards if the zero pin is first removed fron its position at the left hand side of the table mounting. A table traverse of 12" (305 mm) can be obtained with both manual and hydraulic feed systems. When required, the length of stroke can be limited by means of stop collars mounted on the threaded shaft situated beneath the table.

HYDRAULIC SYSTEM (WHERE FITTED) :

Hydraulic pressure (216H and 316H Models) is generated by a pump driven from the main drive motor and therefore operates only when the motor is running. The working pressure is regulated by the valve situated on the front of the control box and is normally set at 100 P.S.I., but may be increased, if necessary, to 130 P.S.I. The four position lever controls the direction of table traverse so that when the lever is moved away from the operator, the table also moves away from the operator and vice versa. Shifting the lever to its central position will stop the table at any point of its stroke. The handknob controls the rate of feed from zero to a maximum of approximately 33" inches per minute (0.83 meters per minute). The greater the number on the dial setting, the faster the feed. Shifting the control lever to the extreme position will overide the feed setting and provide fast traverse.

MAINTENANCE.

WEEKLY MAINTENANCE :

Remove embedded chips from bandwheel tires.
Clean upper and lower saw blade guide assemblies checking that the thrust roller faces present an unbroken polished ring. Replace thrust roller if face appears scored or unduly abraded.
Lubricate thrust roller bearings and ensure thrust rollers spin freely.
Clean table slideways and charge felt wipers with a few drops of oil. Do not apply oil or grease to slideways as this may cause the adhesion of dirt. Table roller bearings are pre-packed with grease and should not require further attention.
IMPORTANT : DO NOT USE COMPRESSED AIR JET TO CLEAN MACHINE AS CHIPS MAY BE BLOWN ONTO TABLE TRACKS, RESULTING IN ERRATIC OPERATION OF TABLE OR SEIZURE OF ROLLERS.
Lubricate gearbox expanding pulley shaft (grease nipple located behind support arm bearing), master expanding pulley shaft, alignment pin and bush.
Operate variable speed unit over whole working range to disperse lubricant, with motor running.
Check that the expanding pulley faces and variable speed belt are free from grease and dirt.

MONTHLY MAINTENANCE :

Remove air filter from top of air compressor (one screw) and insert a few drops of oil onto screw hole. Do not crush filter when replacing screw.
Check condition and tension of vee-belts. Do not adjust tension of variable speed belt as this is automatically determined by the spring pressure and displacement of the gearbox expanding pulley.
Lubricate table hand feed mechanism (216 and 316 Models).
Check level of hydraulic oil in tank (216H and 316H Models).
Clean lamp housing lens.

YEARLY MAINTENANCE :

Drain gearbox, and refill with clean oil to level of filler hole.
Gearbox capacity approximately 1 imperial pint (0.6 litres).
Drain hydraulic system (where fitted), clean tank and replace filter Part Number BO2569 . Refill with 14 imperial pints (8 litres) of clean hydraulic oil and operate controls to remove air locks, see page 5.
Grease motor bearings. If the motor is not fitted with grease nipples, the motor bearings are pre-packed with grease and will operate for long periods without further lubrication.
Check tension and grease control chain to master expanding pulley.
Check operation of remote control cables to gearbox and adjust if necessary.
Check speed control reading against actual speed obtained by tachometer applied to bandwheel and recalibrate speed control if necessary, see page 9.

SECTION 61

MAINTENANCE (CONTINUED).

GENERAL :

Otherwise than above, clean and lubricate working parts as required. The bandwheels, hydraulic and coolant pumps (where fitted) have sealed-for-life bearings which do not require further lubrication. Periodically inspect the welder and grinder units, see Section on Die Making / Welding for instructions.

APPROVED LUBRICANTS	
GENERAL LUBRICATION THRUST ROLLERS TABLE SLIDEWAY WIPERS AIR COMPRESSOR	ESSO Esstic 50 Oil GULF Service 51 Oil MOBIL Mobilgear 629 Oil TEXACO Ursa P20 Oil SHELL Tellus 68 Oil
VARIABLE SPEED PULLEY SHAFTS VARIABLE SPEED CONTROL CHAIN TABLE ROLLER BEARINGS MOTOR BEARINGS	ESSO Beacon 3 Grease GULF Gulfcrown No.3 Grease MOBIL Mobilplex 48 Grease TEXACO Regal Starfak Premium 3 Grease SHELL Alvania 3 Grease
GEARBOX	ESSO Pen-o-led EP2 Oil GULF EP65 Lubricant Oil MOBIL Mobilgear 629 Oil TEXACO Meropa 2 Lubricant Oil SHELL Macoma R150 Oil
HYDRAULIC SYSTEM (Where fitted)	ESSO Nuto H44 Oil GULF Harmony 43AW Oil MOBIL D.T.E. 24 Oil TEXACO Rando HDA Oil SHELL Tellus 37 Oil

TO FIT A NEW VARIABLE SPEED BELT.

Run the machine at 50 feet per minute (15 meters per minute) and switch off. From the rear of the machine, slacken the control chain by adjustment of the jockey wheels. Release the four screws securing the plummer block on which the master expanding pulley assembly is mounted and slide the plummer block towards the gearbox. Remove the two fitting bolts which secure the support arm to the gearbox and swing the arm sideways to permit removal of the old belt. It is important that the automatic expanding pulley shaft is not subjected to strain while it is in the unsupported condition. Install the new belt and replace the fitting bolts to secure the support arm. Feed the belt over the pulleys and position the plummer block to give 17¾" (450 mm) between pulley centers. Tighten securing screws and tension the control chain. Check calibration of speed selector dial.

CALIBRATION OF SPEED SELECTOR DIAL.

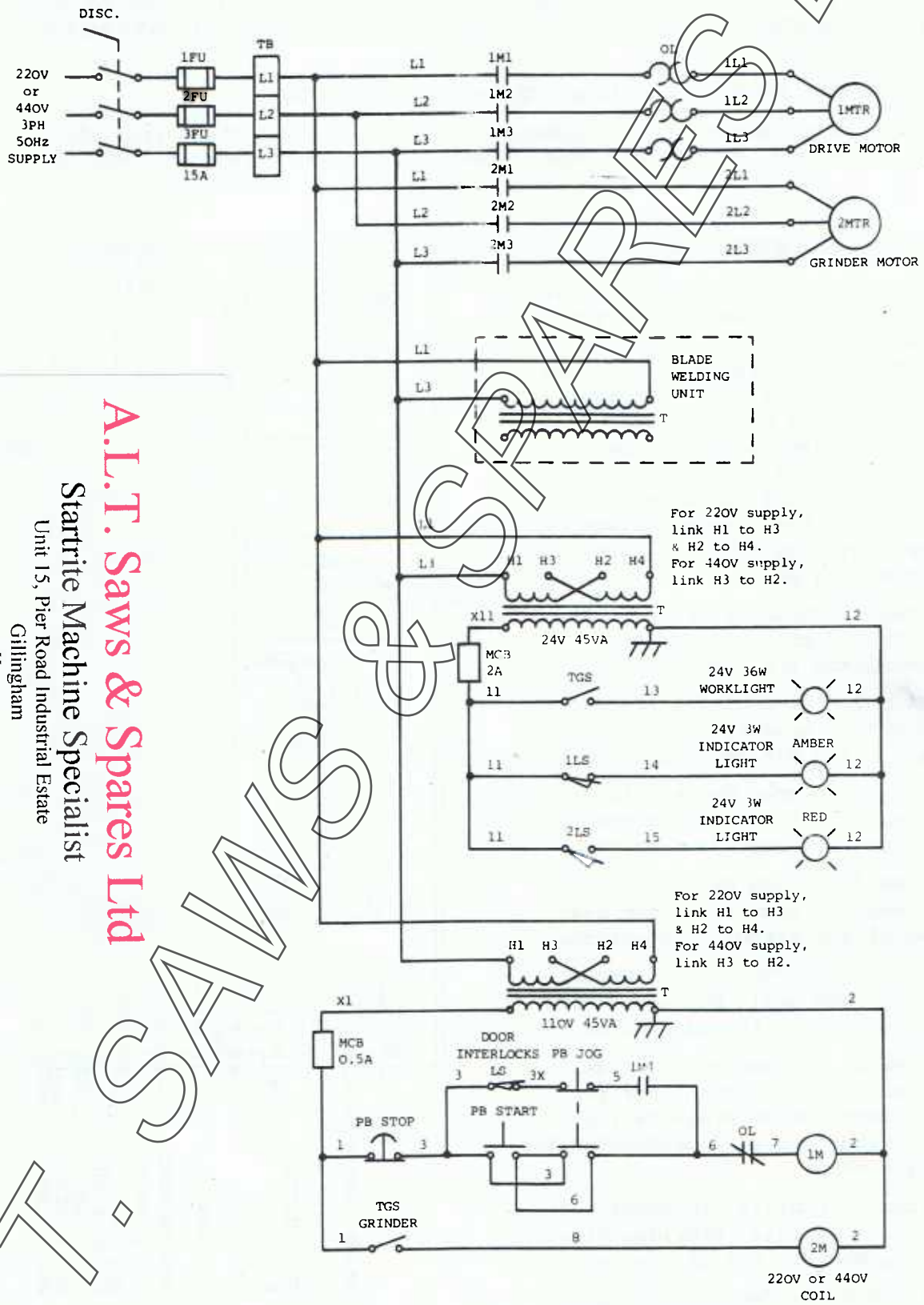
1.
With the aid of the tachometer, set the machine running with the bandwheels rotating at 120 r.p.m. which should give an indicated reading on the speed selector dial of 500 feet per minute (150 meters per minute).

2.
If this proves to be the case, proceed to step 4.

3.
Without disturbing the setting of the machine, remove the operating hand-wheel of the speed selector dial (retained by a circlip). Withdraw the drum until it is disengaged, and re-locate to give a reading of 500 feet per minute (150 meters per minute). Replace circlip.

4.
Run the machine at 3000 feet per minute (914 meters per minute) as indicated on the speed selector dial. If this results in a tachometer reading of 720 r.p.m. at the bandwheels, the system is accurately calibrated, otherwise proceed to step 5.

5.
From the rear of the machine, slacken the control chain by adjustment of the two jockey wheels. Release the four screws securing the plummer block on which the master expanding pulley is mounted. If the tachometer reading was less than 720 r.p.m., move the plummer block a fraction of an inch further away from the gearbox. Likewise, if the tachometer reading was more than 720 r.p.m., move the plummer block towards the gearbox. Tighten the securing screws and re-check bandwheel speed with tachometer. When the operation is completed, adjust chain tension.



CIRCUIT DIAGRAM FOR 220/440V 3PH 50Hz MACHINES.

SECTION 66

WIRING INSTRUCTIONS.

If the machine is of the correct voltage, connect supply leads to terminals L1, L2 and L3 in terminal box (or disconnect switch if fitted) at rear of machine.

IMPORTANT : DO NOT SHIFT GEAR WHEN MOTOR IS RUNNING.

Check motor rotation, saw blade must pass downward through the table. If necessary, interchange supply leads L1 and L3 to reverse rotation.

ELECTRIC CONTROL PANEL.

The electric control panel, see Fig.1, is located inside the machine body, and access is obtained by opening the hinged panel cover situated at the rear of the machine body. The complete panel may be removed from the machine by disconnecting the external wires to the terminal block and removing securing nuts retaining panel.

Item 1. Davenset transformer 220/440V primary, 24V 45VA secondary for worklight.

Item 2. Davenset transformer 220/440V primary, 110V 45VA secondary for control circuit.

Item 3. Dorman Smith circuit breaker 0.5 amp rating for 110V control circuit protection.

Item 4. Dorman Smith circuit breaker 2 amp rating for 24V worklight circuit protection.

Item 5.
contactor . Provides Start/ Stop control for main motor.

Item 6. overload unit (see Chart on page 3 for part numbers and amperage ratings). Provides overload protection for main motor.

Item 7.
contactor . Provides Start/ Stop control for grinder motor.

Items 8 & 9. Terminal blocks.

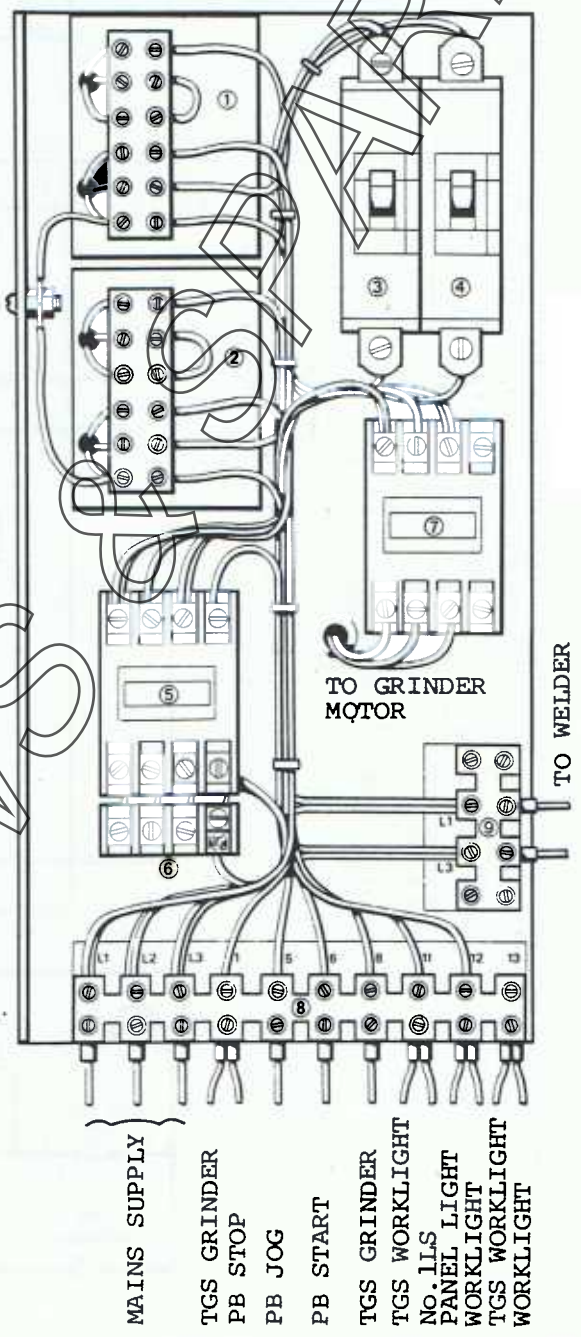


Fig.1.

CONVERSION FOR ALTERNATIVE SUPPLY VOLTAGE.

220 Volt machines will operate on 220/240V 3PH 50Hz supply.
440 Volt machines will operate on 380/440V 3PH 50Hz supply.
Machines supplied for use on 440V 3PH 50Hz supply may be adapted to operate on 220V 3PH 50Hz supply and vice-versa.

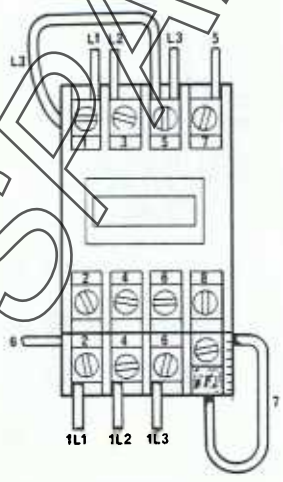
To effect conversion, it is necessary :-

A. Replace the motor overload unit with one of suitable rating.
B. Change the transformer terminal connections.
C. Replace the welder unit.
D. Change the grinder motor connections.
E. Change the main drive motor terminal connections.

Proceed as follows :-

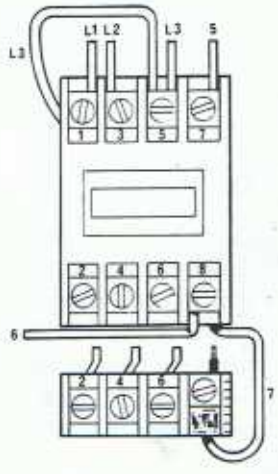
A.

Open control panel cover situated at rear of machine. Identify motor starter and overload unit, see Fig.2. Remove overload unit from starter after slackening starter terminal screws 2,4, 6 & 8, and disconnecting wire 7. Fit alternative overload unit of suitable amperage rating according to supply voltage, (see Chart below). Set pointer at side of overload unit to indicate full load amps of motor.



OVERLOAD UNIT FITTED

Fig.2.

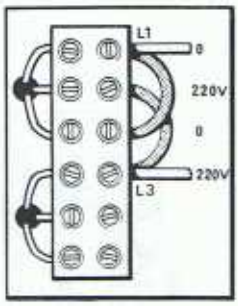


OVERLOAD UNIT DETACHED

MACHINE TYPE	MOTOR 3 PHASE 50Hz.					OVERLOAD UNIT	
	HP.	RPM.	VOLTS	F/L AMPS	STARTING AMPS	PART No.	AMPS RANGE
216 & 316	3	1000	220 - 240	9.0	54	47L0111	8.0 - 12.0
			380 - 440	5.4	32	47L0109	4.0 - 6.2

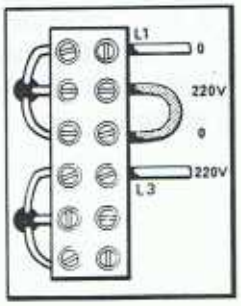
B.

On control panel, identify transformers and substitute links to suit supply voltage, as shown in Fig.3. (Split primary coil transformers only).



2 LINKS FOR 220V 3PH SUPPLY.

Fig.3.



1 LINK FOR 440V 3PH SUPPLY.

C.

The blade welding unit cannot be used on an alternative voltage to that for which it is supplied and must be replaced as follows :- Disconnect the welder leads (marked L1 & L3, see Fig.4) from the terminal block at the side of the control panel. From the front of the machine remove the welder unit. Install the replacement welder unit in reverse order using the same electrical connections as before.

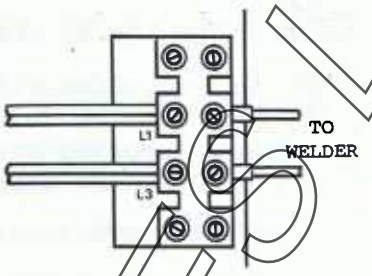


Fig.4.

D.

On control panel, identify contactor on right of panel (see Fig.5). Change the grinder motor wires to suit supply voltage as shown.

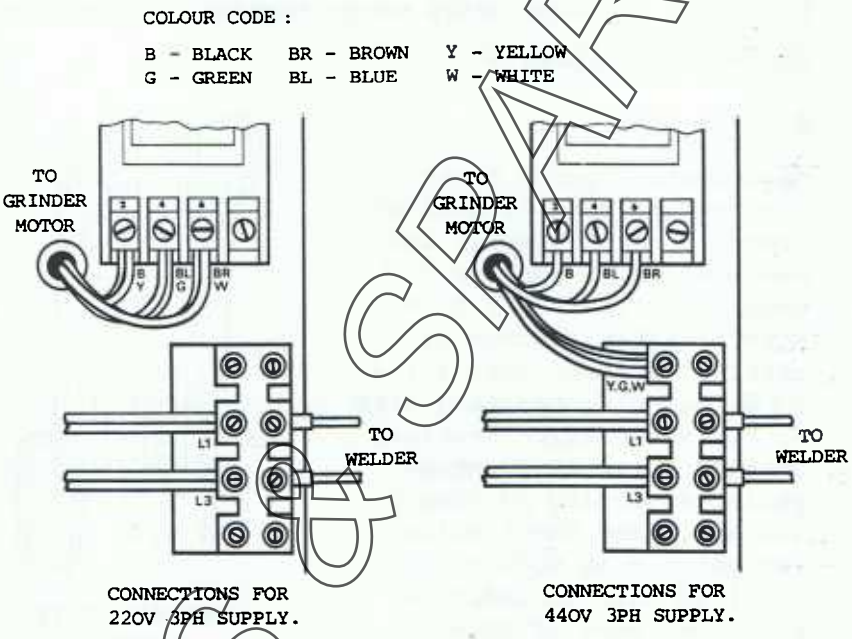


Fig.5.

E.

Remove cover of motor terminal box. Identify main drive motor terminal arrangements, see Figs. 6 & 7. Change the motor terminal linkage to suit appropriate voltage as shown.

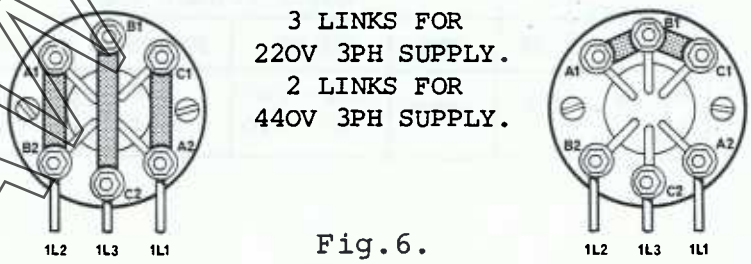


Fig.6.

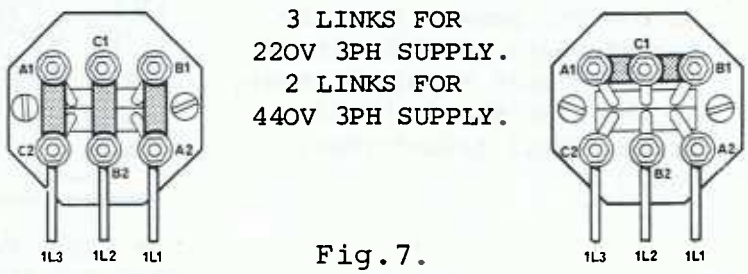


Fig.7.

SETTING UP THE MACHINE.

The first consideration is to select the correct type and width of saw blade for the job as outlined in Section on Sawing Practice.
If the work involves internal contour sawing, or the blade is to be made up from bulk strip, refer to Section on Die Making/Welding.

Close attention must be given to the following setting procedure, as a bandsaw blade is a comparatively fragile cutting tool which is unlikely to give satisfactory performance unless tracked, tensioned and supported in the proper manner.

Lower the top bandwheel by turning the blade tension control knob and remove existing saw blade. Place selected saw blade over the bandwheels with the teeth facing forward and downward through the table, and apply sufficient blade tension to remove slack. It is important that both the top and bottom guide assemblies are set back clear of the saw blade so that it is not deflected and follows a true path between the bandwheels. With the gearshift in the neutral position, rotate the bandwheels by hand to establish the path of the saw blade. Adjust the tracking control knob to position the saw blade approximately on the center of the bandwheels as shown below in Fig.1.

TRACKING CORRECT	TRACKING INCORRECT	TRACKING INCORRECT
Blade runs approximately central on bandwheel.	Blade runs toward front edge of bandwheel.	Blade runs toward rear edge of bandwheel.

Fig.1.

NOTE : 316 and 316H Models have a tracking control fitted to both the top and third bandwheels. Care must be taken when setting these machines in order to avoid conflicting settings between the tracking controls. For this reason, the top bandwheel should be set in the mean position and the tracking controlled from the third bandwheel. After this procedure has been completed, a small final adjustment may be necessary to the top bandwheel control. This point does not arise of course when the machine is to be used on two wheel operation as the tracking procedure is carried out solely by the top bandwheel control.

When the saw blade tracks in a satisfactory manner, apply the appropriate blade tension as shown by the tension indicator, see Fig.2. The tension scale registers tension applied in terms of saw blade width, thus a reading of '½' indicates that tension to suit a ½" wide saw blade has been applied. The saw blade length, provided that it is acceptable to the machine, does not affect the indicated tension. The indicator will give a fair guide as to the correct tension required, but it may be necessary to vary this slightly according to circumstances.

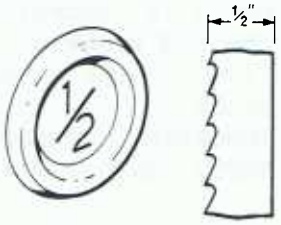
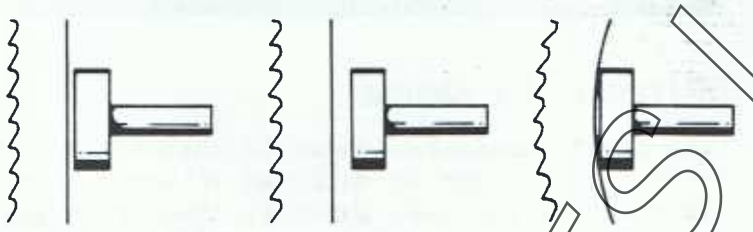


Fig.2.

Set the thrust rollers to support the back edge of the saw blade when finger pressure is applied to the blade teeth. There should be a small gap (.010" approx., see Fig.3) between the saw blade and the thrust roller face when pressure is removed. Check that the thrust rollers rotate freely when cutting pressure is applied to the saw blade.



CORRECT
Thrust roller .010" max. from back edge of saw blade.

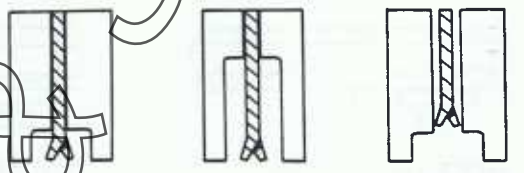
INCORRECT
Thrust roller not supporting saw blade.

INCORRECT
Thrust roller deflecting saw blade.

Fig.3.

Fit correct size insert into guide holders (see Parts List on page 4) and adjust the guides to support the saw blade in its natural path with the minimum of side clearance (.002" to .004"). A quick and positive method of setting the guides is to position one guide insert to just contact the saw blade, then adjust the second insert to contact the saw blade plus a .002" feeler gage. After setting the gap in both the top and bottom blade guides, rotate bandwheels by hand to check that the welded joint of the saw blade does not jam as it passes through the blade guides.

The correct size guide inserts should always be used as they offer maximum support to the saw blade (see Fig.4). Should the correct size guide insert not be available, guide inserts to suit the next size narrower saw blade may be used as an emergency measure.
IMPORTANT : Never use wider size guide inserts as this would instantly destroy the teeth of the saw blade.



CORRECT INCORRECT INCORRECT

Fig.4.

When fitting a saw blade which is identical to the one previously in use, it will not normally be necessary to re-set the blade guides, but some slight adjustment to the tracking may be required. It is most important that the top and bottom blade guides are positioned as close to the table as is practical so as to give maximum support to the saw blade.

Set the machine to run at recommended blade speed. Operation of the gear shift lever at the front of the machine, selects a low speed range of 50 - 360 feet per minute (15 - 110 meters per minute), or a high speed range of 500 - 3600 feet per minute (150 - 1100 meters per minute).
IMPORTANT : DO NOT SHIFT GEAR WHEN MOTOR IS RUNNING.
SHIFTING GEAR WHEN MOTOR IS RUNNING WILL DAMAGE GEARBOX.
The motor can be jogged to facilitate engaging gear, but allow motor to stop before operating gear shift lever. Variation of saw speed in each range is controlled by the speed selector dial at the front of the machine. The red scale on the dial indicates saw speed in low gear (red signal light on), and the amber scale indicates saw speed in high gear (amber signal light on).
IMPORTANT : OPERATE SPEED CONTROL DIAL ONLY WHEN MOTOR IS RUNNING. TURNING SPEED CONTROL DIAL WITH MOTOR STOPPED WILL DAMAGE VARIABLE SPEED DRIVE.

The recommended speed for the various materials will be found suitable for average operational conditions. Some improvement to the cutting performance may be obtained by slight variation from these speeds as the recommendations cannot allow for condition of the saw blade and the shape of the workpiece.

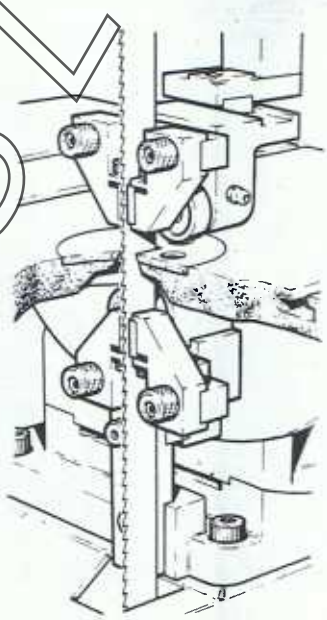
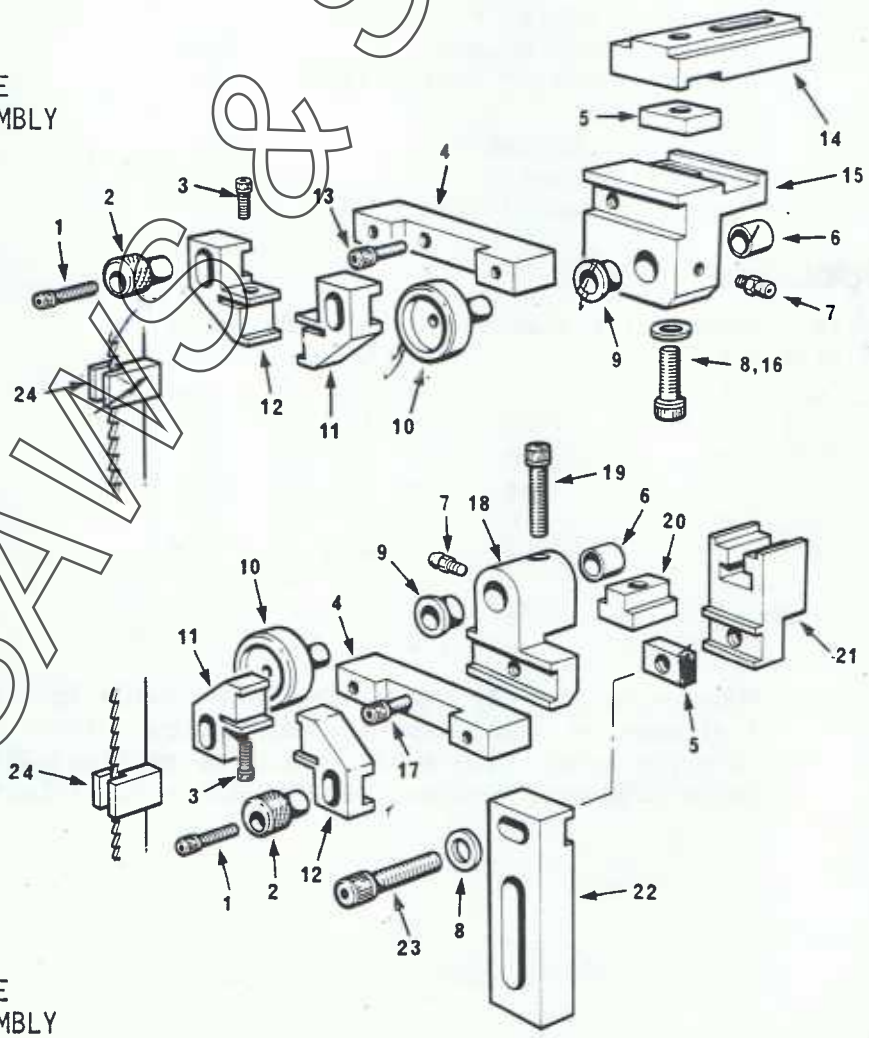


Fig.5.

STANDARD BLADE GUIDES.

The standard top and bottom blade guide assemblies, illustrated in Fig.5, have interchangeable carbide guide inserts. Each set of guide inserts are suitable for use with one size of saw blade only. Guide inserts for ⅜", ½", ⅝" & ¾" wide saw blades are supplied as standard equipment with the machine. Guide inserts for ⅛", 5/32", 3/16", ¼", 5/16" & 1" wide saw blades are also available as optional extras. (NOTE : The guide inserts for 1" wide saw blades require the use of alternative guide holders, see Parts List on page 4).

UPPER BLADE
GUIDE ASSEMBLY



LOWER BLADE
GUIDE ASSEMBLY

UPPER BLADE GUIDE ASSEMBLY - PART No.SP448

ITEM	PART NUMBER	DESCRIPTION	No. OFF
1	BO5011	Soc.Cap Screw	2
2	2459	Adjustment Knob	2
3	BO5007	Soc.Cap Screw	2
4	3436	Horizontal Adjuster	1
5	3435	Key	1
6	BOS1376	Compo Bush	1
7	BO2479	Grease Nipple	1
8	BO5919	Std.Washer	1
9	BOS1008	Compo Bush	1
10	3434	Thrust Roller	1
11	3439	Guide Holder - L.H.	1
12	3440	Guide Holder - R.H.	1
13	BO5018	Soc.Cap Screw	1
14	3443	Fore & Aft Adjuster	1
15	3444	Horizontal Adjuster	1
16	BO5036	Soc.Cap Screw	1

LOWER BLADE GUIDE ASSEMBLY - PART No.SP447

NOTE : Items 1 to 12 of SP448 common to SP447. Quantities also as per SP448.

17	BO5019	Soc.Cap Screw	1
18	3441	Thrust Roller Housing	1
19	BO5022	Soc.Cap Screw	1
20	3432	Captive Nut	1
21	3437	Fore & Aft Adjuster	1
22	3438	Vertical Adjuster	1
23	BO5037	Soc.Cap Screw	1

BLADE GUIDE INSERTS

24	3334/1	Blade Guide Inserts for 1/16" wide blade	4
	3334/2	" " " " 1/8" " "	4
	3334/3	" " " " 5/32" " "	4
	3334/4	" " " " 3/16" " "	4
	3334/5	" " " " 1/4" " "	4
	3334/6	" " " " 5/16" " "	4
	3334/7	" " " " 3/8" " "	4
	3334/8	" " " " 1/2" " "	4
	3334/9	" " " " 5/8" " "	4
	3334/10	" " " " 3/4" " "	4
	3581	" " " " 1" " "	4

* NOTE : When using 1" wide saw blade, blade guide inserts Part No. 3581 must be used. Also standard guide holders (Items 11 & 12 - Parts Nos.3439 & 3440) must be replaced with special guide holders (Part Nos.3637 & 3638 - Not Illustrated).

ROLLER BLADE GUIDES.

These guides (see Fig.6), which are available as an optional extra, utilise the same location points on the machine as the standard guides and are therefore fully interchangeable with them. The roller guides will be found useful for the continuous high speed sawing of plastics and non ferrous materials etc. Rollers are available to suit ½", ⅝" or ¾" wide saw blades, see Parts List on page 6.

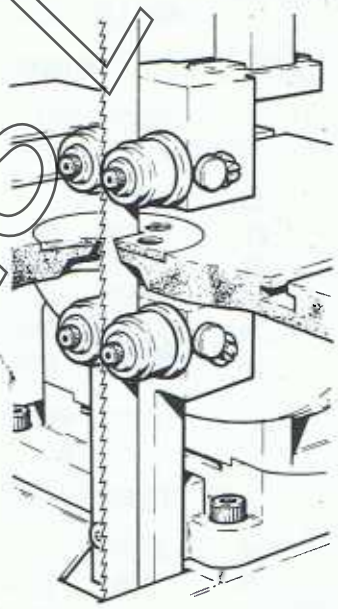
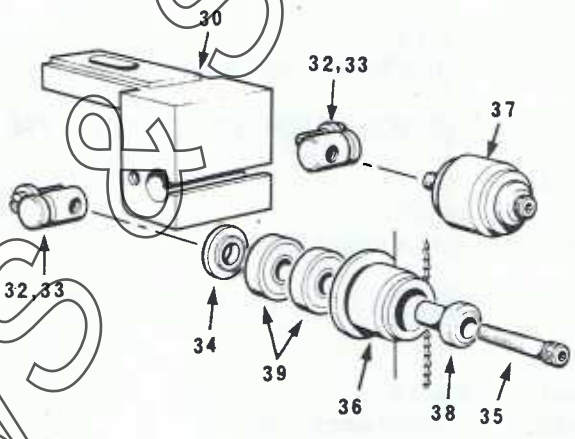
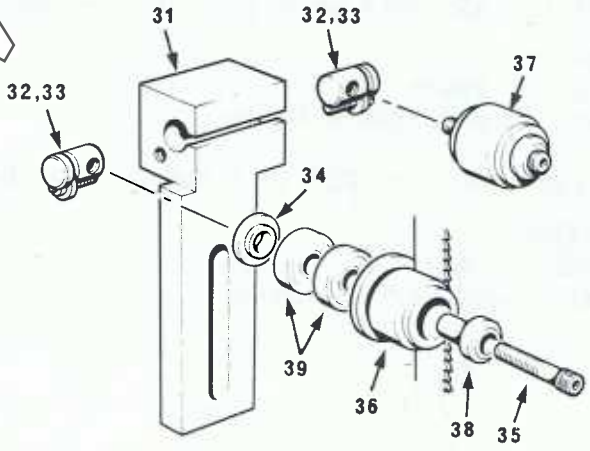


Fig.6.

ROLLER BLADE GUIDES - UPPER



ROLLER BLADE GUIDES - LOWER



SECTION 69

ROLLER BLADE GUIDE ASSEMBLY - PART No.SP416

ITEM	PART NUMBER AND DESCRIPTION		No.OFF
	NOTE : Rollers are not included with this assembly and must be ordered separately.		
30	3254	Roller Housing - Upper	1
31	3255	Roller Housing - Lower	1
32	3171	Sliding Nut	4
33	3307	Adjusting Screw	4
34	3180	Spacer	4
35	BO5022	Soc.Cap Screw	4
	NOTE : When ordering rollers, 2 sets of flanged rollers, and 2 sets of plain rollers required per machine.		
	FLANGED ROLLER ASSEMBLY (FOR ¾" BLADE) - PART No.SP427A		
36	3175	Roller	1
38	3178	Bearing Shaft	1
39	BO2004	Ball Race	2
	PLAIN ROLLER ASSEMBLY (FOR ¾" BLADE) - PART No.SP427B		
37	3172	Roller	1
38	3178	Bearing Shaft	1
39	BO2004	Ball Race	2
	FLANGED ROLLER ASSEMBLY (FOR ⅝" BLADE) - PART No.SP428A		
36	3176	Roller	1
38	3178	Bearing Shaft	1
39	BO2004	Ball Race	2
	PLAIN ROLLER ASSEMBLY (FOR ⅝" BLADE) - PART No.SP428B		
37	3173	Roller	1
38	3178	Bearing Shaft	1
39	BO2004	Ball Race	2
	FLANGED ROLLER ASSEMBLY (FOR ½" BLADE) - PART No.SP429A		
36	3177	Roller	1
38	3178	Bearing Shaft	1
39	BO2004	Ball Race	2
	PLAIN ROLLER ASSEMBLY (FOR ½" BLADE) - PART No.SP429B		
37	3174	Roller	1
38	3178	Bearing Shaft	1
39	BO2004	Ball Race	2

ANGLED ROLLER BLADE GUIDES.

These blade guides (see Fig.7), are available as an optional extra. Similar in construction to the roller guides (see pages 5 & 6), except that the rollers are set at an angle to the guide body. By this means the saw blade is twisted at an angle of 40° to the axis of the table, so as to overcome the limited capacity of the throat size when sawing across a long narrow workpiece, see Figs.8 & 9. When angled blade guides are being used the blade speed should not exceed 350 feet per minute (105 meters per minute). Rollers are available for ½", ⅝" and ¾" wide saw blades, see Parts Lists on pages 6 & 8.

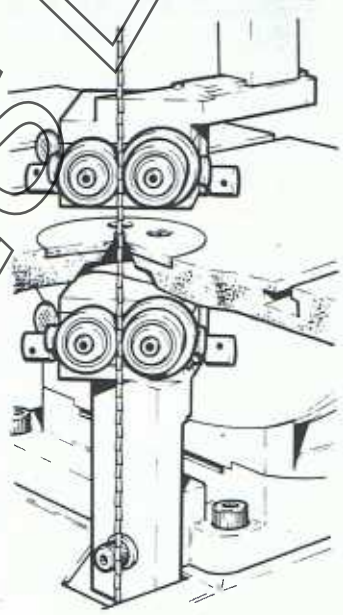
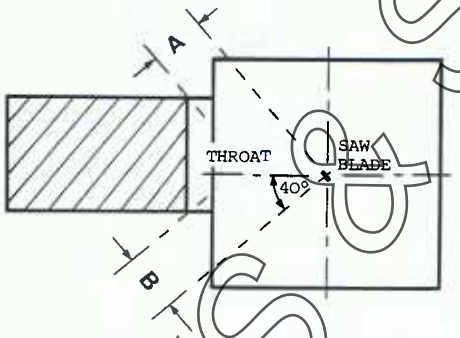


Fig.7.



Throat capacity with saw blade twisted at 40°:-

Dimension 'A' - 216/216H : 5¼"
316/316H : 21¼"

Dimension 'B' - 216/216H : 7½"
316/316H : 21"

Fig.8.

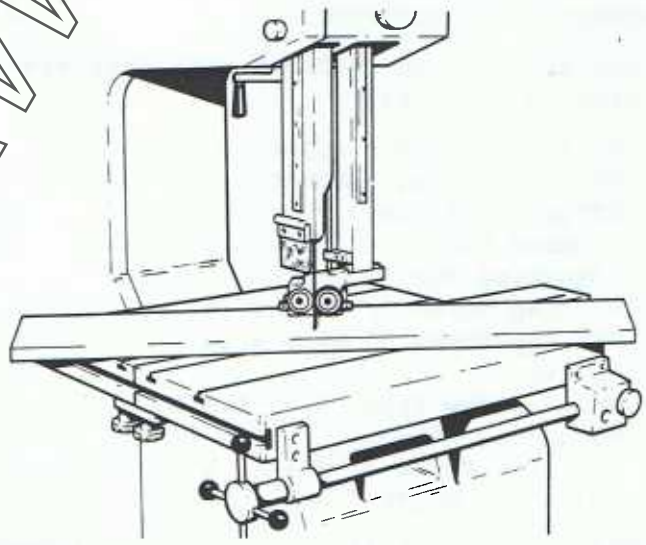
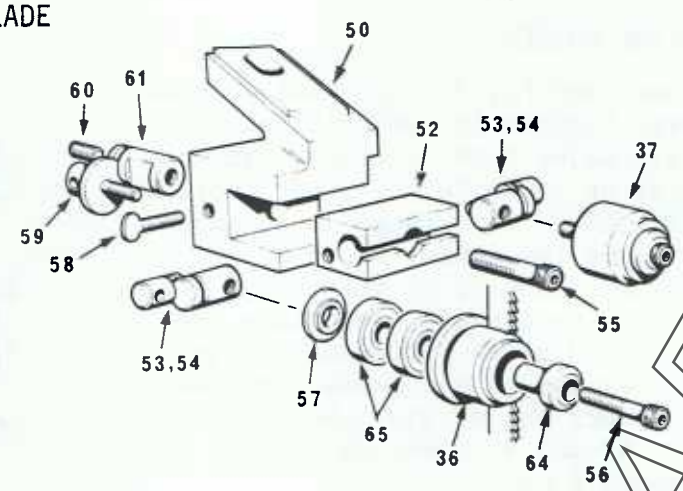
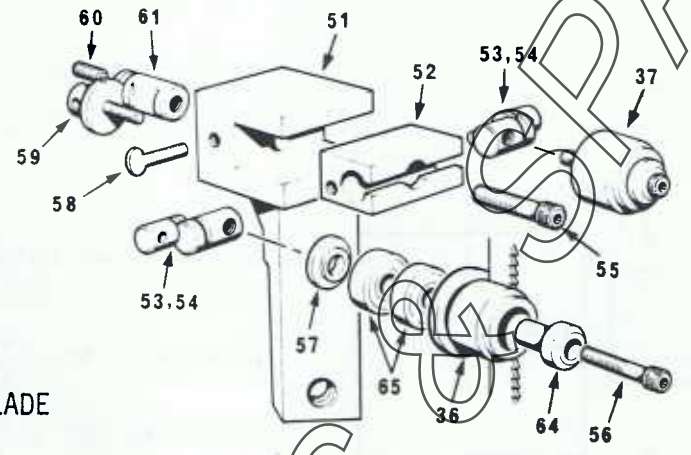


Fig.9.

ANGLED ROLLER BLADE GUIDES - UPPER





ANGLED ROLLER BLADE GUIDES - LOWER

ANGLED ROLLER BLADE GUIDE ASSEMBLY - PART No.SP401

A = TOP
B = BOTTOM

ITEM	PART NUMBER	AND DESCRIPTION	No.OFF
	NOTE : Rollers are not included with this assembly and must be ordered separately.		
50	3170	Roller Housing - Upper	1
51	3169	Roller Housing - Lower	1
52	3184	Adjusting Block	2
53	3171	Sliding Nut	4
54	3182	Adjusting Nut	4
55	BO5029	Soc.Cap Screw	2
56	BO5022	Soc.Cap Screw	4
57	3180	Spacer	4
58	BO5823	Thumb Screw	2
59	3181	Adjusting Nut	2
60	BOS3075	Soc.Grub Screw	2
61	3183	Adjusting Shaft	2

NOTE : When ordering rollers, 2 sets of flanged rollers, and 2 sets of plain rollers required per machine (see Parts List on page 6).

SETTING UP THE MACHINE.

Select a saw blade suitable for the work in hand, see Section on Sawing Practice.
If the work involves internal contour sawing, or the blade is to be made up from bulk strip, refer to Section on Welder & Grinder Units.

Lower the top bandwheel by turning the blade tension control knob and remove saw blade. Place selected saw blade over bandwheels with the teeth facing forward and downward through the table (see Fig.1), and apply sufficient blade tension to remove slack. It is important that both the top and bottom guide assemblies are set back clear of the saw blade so that it is not deflected and follows a true path between the bandwheels. With the gearshift in the neutral position, rotate the bandwheels by hand to establish the path of the saw blade. Adjust the tracking control knob to position the saw blade approximately central on the bandwheels as shown in Fig.2.

Fig.1.

TRACKING CORRECT
Blade runs approximately central on bandwheel.

TRACKING INCORRECT
Blade runs toward front edge of bandwheel.

TRACKING INCORRECT
Blade runs toward back edge of bandwheel.

Fig.2.

NOTE : 316 Models have a tracking control fitted to both the top and third bandwheels. Care must be taken when setting these machines in order to avoid conflicting settings between the tracking controls. For this reason, the top bandwheel should be set in the mean position and the tracking controlled from the third bandwheel. After this procedure has been completed, a small final adjustment may be necessary to the top bandwheel control. This point does not arise of course when the machine is to be used on two wheel operation as the tracking procedure is carried out solely by the top bandwheel control.

When the saw blade tracks in a satisfactory manner, apply the appropriate blade tension as shown by the tension indicator, see Fig.3. The tension scale registers tension applied in terms of saw blade width, thus a reading of '¾/20 mm' indicates that tension to suit a ¾" or 20 mm wide saw blade has been applied. The saw blade length, provided that it is acceptable to the machine, does not affect the indicated tension. The indicator will give a fair guide as to the correct tension required, but it may be necessary to vary this slightly according to circumstance.

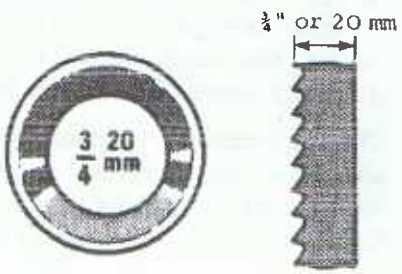
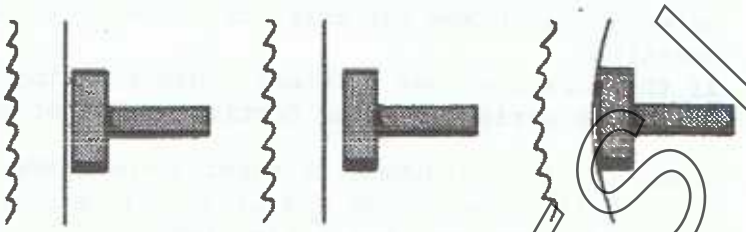


Fig.3.

SETTING UP THE MACHINE (CONTINUED).

Set the thrust rollers to support the back edge of the saw blade when finger pressure is applied to the blade teeth. There should be a small gap (approx. .010" - see Fig.4) between the saw blade and the thrust roller face when pressure is removed. Check that thrust rollers rotate freely when cutting pressure is applied to saw blade.



CORRECT
Thrust roller .010" max. from back edge of blade.

INCORRECT
Thrust roller not supporting blade.

INCORRECT
Thrust roller deflecting blade.

Fig.4.

Fit correct size Chevron guide into guide holder (see Parts List on page 4) and adjust the guides to support the saw blade in its natural path with the minimum of side clearance (.002" to .004"). A quick and positive method of setting the guides is to position one guide to just contact the saw blade, then adjust the second guide to contact the saw blade plus a .002" feeler gauge. After setting the gap in the top and bottom blade guides, rotate bandwheels by hand to check that the welded joint of the saw blade does not jam as it passes through the blade guides.

The correct size guides should always be used as they offer maximum support to the saw blade (see Fig.5). Should the correct size guides not be available, guides to suit the next size narrower saw blade may be used as an emergency measure.
IMPORTANT: Never use wider size guides as this would instantly destroy the teeth of the saw blade.

CORRECT INCORRECT INCORRECT

Fig.5.

When fitting a saw blade which is identical to the one previously in use, it will not normally be necessary to re-set the blade guides, but some slight adjustment to the tracking may be required.

It is most important that the bottom guide is positioned as close to the underside of the table as possible and the top guide positioned as close to the workpiece as is practical to give maximum support to the saw blade. Using the machine with incorrectly adjusted guides can only result in poor quality work and short blade life.

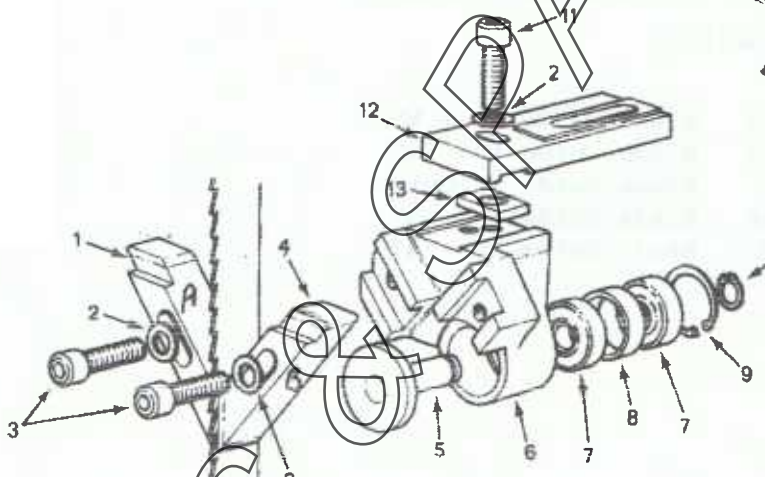
The recommended speed for the various materials will be found suitable for average operational conditions. Some improvement to the cutting performance may be obtained by slight variation from these speeds as the recommendations cannot allow for condition of saw blade and the shape of the workpiece.

The recommended speed for the various materials will be found suitable for average operational conditions. Some improvement to the cutting performance may be obtained by slight variation from these speeds as the recommendations cannot allow for condition of the saw blade and the shape of the workpiece.

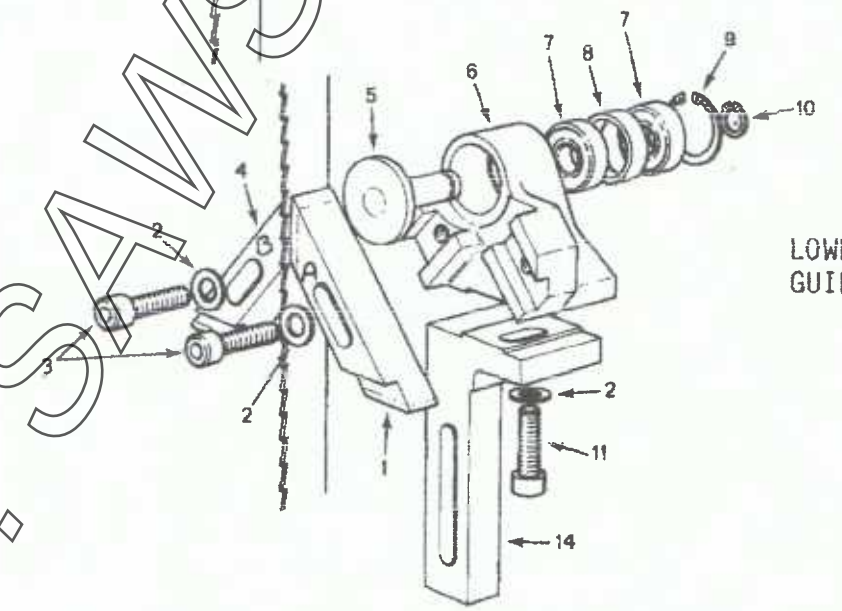
CHEVRON BLADE GUIDES.

The chevron top and bottom blade guide assemblies illustrated in Fig.6. have interchangeable carbide blade guides. A set of double ended guides for ½" and ¾" wide saw blades are supplied as standard equipment with the machine. Double ended guides for ¼" and ⅜", ½" and ⅝" and single ended guides for 1" wide saw blades are also available as optional extras.

Fig.6.



UPPER BLADE GUIDE ASSEMBLY



LOWER BLADE GUIDE ASSEMBLY

CHEVRON GUIDE ASSEMBLIES - SM1661 LOWER GUIDE ASSEMBLY
SM1662 UPPER GUIDE ASSEMBLY

ITEM	PART NUMBER	DESCRIPTION	NO. OFF
1	SM1659/2A	Blade Guide ¾" - ½"	2
2		Washer	6
3		Soc. Hd. Cap Screw	4
4	SM1659/2B	Blade Guide ½" - ¾"	2
5	SM1660	Blade Thrust Plate	2
6	7807	Blade Guide Housing	2
7		Bearing	4
8	7819	Bearing Spacer	2
9		Circlip Internal	2
10		Circlip External	2
11		Soc. Hd. Cap Screw	2
12	7923	Upper Guide Plate	1
13	7992	Key	1
14	7808	Guide Housing Bracket	1

OPTIONAL BLADE GUIDES.

15	SM1659/1A	Blade Guide ½" - ⅜"	2
16	SM1659/1B	Blade Guide ⅜" - ½"	2
17	SM1659/3	Blade Guide 1" Only	4
18	SM1659/4A	Blade Guide ⅝" - ¾"	2
19	SM1659/4B	Blade Guide ¾" - ⅝"	2

SAW AND SPEED SELECTION CHART.

MATERIAL	WATER TO STARCOOL RATIO		MATERIAL THICKNESS				
			UNDER ¼"	¼"-½"	½"-1"	1"-3"	3"-6"
ANILINE FORMALDEHYDE	-	FPM	3500	3200	3000	2900	2800
		TPI	18	14	10	3S	3S
ALUMINIUM - Die Casting	20	FPM	1500	1200	900	750	500
		TPI	18	10	8	6S	3S
ALUMINIUM - Sand Cast Alloy	20	FPM	1200	1000	800	600	400
		TPI	18	14	10	6S	3S
ALUMINIUM - Rolled & Extruded Sections	20	FPM	2500	2000	1500	1400	1200
		TPI	18	10	8	6S	3S
ASBESTOS - Corrugated	-	FPM	3000	3000	3000	3000	
		TPI	14	10	6	3S	
ASBESTOS - Paper	-	FPM	3000	3000	3000	2800	2500
		TPI	10	8	6	3S	3S
ASBESTOS - Wall Board	-	FPM	150	100	100	100	
		TPI	14	10	6	3S	
BABBIT	20	FPM	2500	2000	1500	1200	
		TPI	18	14	8	6	
BAKELITE	-	FPM	2500	2300	2000	1500	1200
		TPI	14	10	8	6S	3S
BERYLLIUM	20	FPM	175	150	100	75	50
		TPI	18	14	10	8	4H
BONE	-	FPM	3500	3200	3000	3000	
		TPI	10	8	6	3S	
BRAKE LINING	-	FPM	300	250	200	200	200
		TPI	14	10	8	6	3S
BRASS - Cast	-	FPM	350	300	200	150	
		TPI	18	14	6	3S	
BRASS - Hard Drawn	-	FPM	360	330	300	280	250
		TPI	18	14	8	6	3S
BRASS - Soft Commercial	-	FPM	2500	2000	1500	1300	1200
		TPI	18	14	8	6	3S
BRONZE - Aluminium	-	FPM	330	320	300	250	
		TPI	18	14	10	6	
BRONZE - Manganese	-	FPM	800	600	350	300	200
		TPI	18	14	8	6	3S

Speeds indicated are for Carbon Steel Saw Blades.
(Regular tooth where not stated otherwise.)
H = Hook Tooth S = Skip Tooth SC = Scallop Blade KN = Knife Edge Blade
W = Water FPM = Feet Per Minute TPI = Teeth Per Inch

SAW AND SPEED SELECTION CHART.

MATERIAL	WATER TO STARCOOL RATIO		MATERIAL THICKNESS				
			UNDER ¼"	¼"-½"	½"-1"	1"-3"	3"-6"
BRONZE - Phosphor	-	FPM	500	350	300	250	200
		TPI	18	14	8	6	3S
BRONZE - Silicon	-	FPM	1200	900	600	400	200
		TPI	18	14	10	6	4H
CADMIUM	-	FPM	3500	3200	3000	2800	2500
		TPI	10	8	6H	4H	4H
CARBON	-	FPM	3600	3600	3600	3000	3000
		TPI	18	14	6	3S	3S
CARDBOARD - Corrugated	-	FPM	3500	3500	3000	3000	3000
		TPI	SC	SC	SC	SC	SC
CARDBOARD - Sheet	-	FPM	3000	3000	3000	2500	2500
		TPI	14	10	8	6H	4H
CELLULOSE ACETATE	20	FPM	3500	3500	3000	2500	2000
		TPI	14	10	8	3S	3S
CELLULOSE NITRATE	W	FPM	1500	1200	1100	1000	900
		TPI	10	8	6S	3S	3S
COPPER - Beryllium	20	FPM	2500	2500	1600	1200	800
		TPI	14	10	6	3S	3S
COPPER - Hard Drawn	20	FPM	800	700	550	400	200
		TPI	18	14	10	6H	4H
COPPER - Commercial Pure	20	FPM	3200	3000	2700	2500	2000
		TPI	18	14	6	3S	3S
CORK	-	FPM	3500	3500	3500	3500	3000
		TPI	14	10	6H	4H	4H
ETHYL CELLULOSE	W	FPM	3500	3000	2500	2000	1500
		TPI	10	8	6	3S	3S
FIBER BOARD	-	FPM	2500	1500	1100	1000	1000
		TPI	18	14	10	6	4H
FORMICA	-	FPM	2900				
		TPI	18				
GLASS BONDED MICA	-	FPM	75	75	50	50	
		TPI	18	14	10	8	
GLASS FIBER	-	FPM	1000	1000	1000	1000	
		TPI	18	14	10	6H	

Speeds indicated are for Carbon Steel Saw Blades.
(Regular tooth where not stated otherwise.)
H = Hook Tooth S = Skip Tooth SC = Scallop Blade KN = Knife Edge Blade
W = Water FPM = Feet Per Minute TPI = Teeth Per Inch

SAW AND SPEED SELECTION CHART.

MATERIAL	WATER TO STARCOOL RATIO		MATERIAL THICKNESS				
			UNDER ¼"	¼"-½"	½"-1"	1"-3"	3"-6"
GLASS FIBER	-	FPM	1000	1000	1000	1000	
		TPI	18	14	10	6H	
GRAPHITE	-	FPM	3000	3000	3000	2500	2500
		TPI	18	14	10	4H	4H
HORN - Animal	-	FPM	2500	2000	1500	1200	1000
		TPI	24	18	14	10	6
IRON - Grey Cast	-	FPM	200	150	125	100	85
		TPI	24	18	14	10	6
IRON - Malleable	-	FPM	275	260	230	200	
		TPI	18	14	10	6	
IRON - Meehanite	-	FPM	150	130	120	110	95
		TPI	18	14	10	6	4H
LEAD	20	FPM	3000	2500	1800	1200	800
		TPI	18	10	10	6S	3S
LEATHER	-	FPM	3500	3200	3000	2800	2500
		TPI	14	10	6	3S	3S
LINEN	-	FPM	3500	3500	3500	3500	
		TPI	KN	KN	SC	SC	
MAGNESIUM	W	FPM	3500	3300	3200	3000	2800
		TPI	14	10	6H	4H	4H
MICA	-	FPM	225	225	200	200	
		TPI	18	14	10	8	
MONEL	-	FPM	150	125	50	50	
		TPI	18	14	8	6H	
NEOPRENE	-	FPM	3000	2800	2500	2300	2000
		TPI	10	8	6	4H	4H
NICKEL SILVER	20	FPM	300	250	200	180	150
		TPI	18	14	10	6	4H
PAPER - Sheet	-	FPM	3000	3000	2500	2500	2000
		TPI	18	14	10	6H	4H
PAPER - Tissue	-	FPM	3500	3500	3500	3000	3000
		TPI	SC	SC	SC	SC	SC
PAPIER MACHE	-	FPM	3500	3500	3000	3000	3000
		TPI	KN	10	6H	4H	4H

Speeds indicated are for Carbon Steel Saw Blades.
(Regular tooth where not stated otherwise.)
H = Hook Tooth S = Skip Tooth SC = Scallop Blade KN = Knife Edge Blade
W = Water FPM = Feet Per Minute TPI = Teeth Per Inch

SECTION 72

SAW AND SPEED SELECTION CHART.

MATERIAL	WATER TO STARCOOL RATIO		MATERIAL THICKNESS				
			UNDER ¼"	¼"-½"	½"-1"	1"-3"	3"-6"
PERSPEX	20	FPM TPI	3500 14	3500 10	3000 6	2500 3S	2500 3S
PHENOL FORMALDEHYDE	-	FPM TPI	3500 14	3500 10	3000 6	3000 3S	2500 3S
PLEXIGLASS	-	FPM TPI	3500 14	3500 10	3000 6	2500 3S	2000 3S
POLYSTYRENE	-	FPM TPI	3000 10	2500 8	2000 6	2000 3S	2000 3S
RUBBER - Crepe	-	FPM TPI	3500 20	3500 8	3500 6	3000 6S	3000 3S
RUBBER - Hard	-	FPM TPI	3000 10	2800 8	2500 6	2300 4H	2000 4H
SILVER	20	FPM TPI	2800 18	2400 14	2200 10	2000 6	1500 3S
SLATE	-	FPM TPI	750 18	700 14	600 10	500 6	
STEEL - Carbon Case Hardening SAE 1010 1012 1016 EN32A/B	20	FPM TPI	180 24	160 14	150 10	140 6H	140 4H
STEEL - 0.2% Carbon SAE 1018-1023 EN3	20	FPM TPI	240 24	210 14	180 10	160 6H	150 4H
STEEL - Carbon Manganese SAE 1024 1027 EN14	20	FPM TPI	240 18	220 14	200 10	175 6	150 4H
STEEL - 0.3% Carbon SAE 1029 1030 EN5	20	FPM TPI	230 24	200 14	180 10	160 6	140 4H
STEEL - 0.4% Carbon SAE 1037-1040 EN8	20	FPM TPI	200 24	150 14	125 10	100 6	95 4H
STEEL - 0.55% Carbon SAE 1054 1055 EN9	20	FPM TPI	200 24	150 14	125 10	100 6H	90 4H
STEEL - Low Carbon Free Cutting SAE 1111-1113 1211-1213 1215 EN1	20	FPM TPI	250 18	220 14	200 10	180 6H	170 4H
STEEL - Case Hardening Free Cutting SAE 1115 1117 EN32M 202	20	FPM TPI	200 24	190 14	180 10	160 6	150 4H
STEEL - 0.4% Carbon Free Cutting SAE 1137-1141 EN8M	20	FPM TPI	230 24	200 14	180 10	160 6	150 4H

Speeds indicated are for Carbon Steel Saw Blades.
(Regular tooth where not stated otherwise.)
H = Hook Tooth S = Skip Tooth SC = Scallop Blade KN = Knife Edge Blade
W = Water FPM = Feet Per Minute TPI = Teeth Per Inch

SAW AND SPEED SELECTION CHART.

MATERIAL	WATER TO STARCOOL RATIO		MATERIAL THICKNESS				
			UNDER ¼"	¼"-½"	½"-1"	1"-3"	3"-6"
STEEL - 3% Nickel SAE 2317 2330-2345 EN33 51	20	FPM TPI	150 18	125 14	100 10	90 6H	75 4H
STEEL - 1% Chrome Molybdenum SAE 4130-4140 EN19 20	20	FPM TPI	150 18	100 14	90 10	60 6H	50 4H
STEEL - 1% Nickel-Chrome- Molybdenum SAE 4340 EN24	15	FPM TPI	150 18	125 14	100 10	75 6H	50 4H
STEEL - 2% Nickel Molybdenum SAE 4640 EN160	15	FPM TPI	150 18	125 14	100 10	75 6H	50 4H
STEEL - 1% Chrome Vanadium SAE 6150 EN47	15	FPM TPI	175 18	125 14	100 10	75 6H	50 4H
STEEL - Nickel-Chrome-Moly- bdenum SAE 8616-8645 EN100	20	FPM TPI	140 18	110 14	90 10	70 6H	50 4H
STEEL - Silicon Manganese SAE 9255 EN45	20	FPM TPI	160 18	140 14	125 10	100 6H	70 4H
STEEL - 3% Nickel Chrome SAE 9310-9217 EN36	15	FPM TPI	125 18	100 14	80 10	60 6H	50 4H
STEEL - 1% Carbon Chrome SAE 50100-52100 EN31	15	FPM TPI	160 24	130 14	100 10	75 6H	50 4H
STEEL - Die D-2 D-3	15	FPM TPI	125 18	100 14	80 10	60 6H	50 4H
STEEL - Die D-7	15	FPM TPI	100 24	80 18	65 10	60 6H	50 4H
STEEL - Hot Working H-12 H-13 H-21	15	FPM TPI	125 18	100 14	75 10	60 6H	50 4H
STEEL - Tool L-6 L-7	15	FPM TPI	115 18	95 14	80 10	65 8	50 4H
STEEL - High Speed M-1	20	FPM TPI	185 18	150 14	125 10	90 6H	60 4H
STEEL - High Speed M-2 M-3 M-4 M-5 M-10	15	FPM TPI	130 18	100 14	80 10	60 6H	50 4H
STEEL - Die O-1 O-2	20	FPM TPI	175 18	150 14	125 10	100 6H	80 4H
STEEL - Die O-6	20	FPM TPI	210 18	180 14	150 10	120 6H	100 4H

Speeds indicated are for Carbon Steel Saw Blades.
(Regular tooth where not stated otherwise.)
H = Hook Tooth S = Skip Tooth SC = Scallop Blade KN = Knife Edge Blade
W = Water FPM = Feet Per Minute TPI = Teeth Per Inch

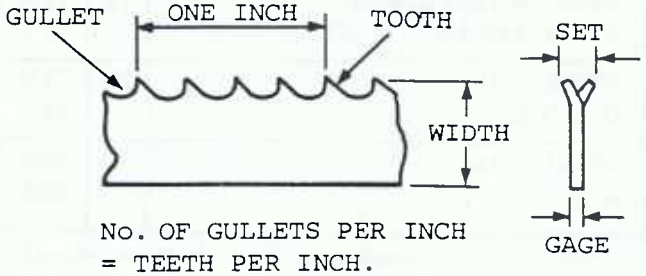
SAW AND SPEED SELECTION CHART.

MATERIAL	WATER TO STARCOOL RATIO		MATERIAL THICKNESS				
			UNDER ¼"	¼"-½"	½"-1"	1"-3"	3"-6"
STEEL - Shock Resisting S-1	15	FPM	125	100	80	65	50
		TPI	18	14	10	6H	4H
STEEL - Shock Resisting S-2 S-5	15	FPM	100	80	60	55	50
		TPI	18	14	10	6H	4H
STEEL - High Speed T-1 T-2	15	FPM	140	110	90	70	55
		TPI	18	14	10	6H	4H
STEEL - High Speed T-4 T-5 T-6 T-8	15	FPM	115	95	85	70	50
		TPI	18	14	10	6H	4H
STEEL - Water Hardening	20	FPM	175	150	125	100	75
		TPI	18	14	10	6H	4H
STRAWBOARD	-	FPM	3500	3500	3000	3000	2500
		TPI	14	10	8	6S	3S
STRING	-	FPM	3500				
		TPI	SC				
TUFNOL	-	FPM	2500	2300	2000	1500	1000
		TPI	14	10	6H	6H	4H
WOOD	-	FPM	3600	3600	3600	3600	3300
		TPI	14	10	6H	4H	4H
ZINC	20	FPM	2500	2300	2000	1500	1000
		TPI	14	10	6H	4H	4H

Speeds indicated are for Carbon Steel Saw Blades.
(Regular tooth where not stated otherwise.)
H = Hook Tooth S = Skip Tooth SC = Scallop Blade KN = Knife Edge Blade
W = Water FPM = Feet Per Minute TPI = Teeth Per Inch

SAW TERMINOLOGY.

An understanding of the design and application of the various types of saw blades obtainable is essential if the bandsawing technique is to be fully exploited. The lowest cost saw blade is not necessarily the most economic to use, whilst use of the more expensive types cannot always be justified.



No. OF GULLETS PER INCH = TEETH PER INCH.

Each type is superior in some way for specific applications and therfore selection should be made in relation to the duty required.

Careful blade selection is necessary for sawing metals if optimum results are to be obtained. The Chart below should provide a useful guide for initial saw blade selection.

QUICK REFERENCE CHART FOR BLADE TYPE SELECTION.

MATERIAL	DUTY REQUIRED				
	GENERAL CUT OFF WORK	LOW PRODUCTION STRAIGHT CUTTING	HIGH PRODUCTION STRAIGHT CUTTING	EXTERNAL CONTOUR CUTTING	INTERNAL CONTOUR CUTTING
Low carbon & free cutting steels, copper, brass, aluminium sections.	CARBON	CARBON	BI-METAL	CARBON	CARBON
Aluminium alloy castings & forgings silicon bronze, aluminium bronze.	CARBON	ALLOY	BI-METAL	CARBON	CARBON
High carbon steels, alloy steels.	ALLOY	ALLOY	BI-METAL	BI-METAL	BI-METAL
High speed steels, stainless steels, tool & die steels.	H.S.S	H.S.S.	BI-METAL	BI-METAL	BI-METAL

CARBON STEEL SAW BLADES are available in the widest range of styles and sizes at low cost. They are suitable for cutting low and medium carbon steels, also the readily machineable non-ferrous alloys. Being easily weldable, they are recommended for internal contour sawing in all but the hardest materials, also where saw blade breakage is a problem due to many operators using the machine for general cut-off work.

ALLOY STEEL SAW BLADES are intermediate in cost and application between carbon and high speed saw blades. Some brands are weldable and these may prove suitable for internal contour sawing harder materials. They are to be preferred on short run work where the extended tool life of high speed steel or bi-metal saw blades cannot be fully utilised.

HIGH SPEED STEEL (H.S.S.) SAW BLADES permit much higher sawing rates than can be obtained with carbon steel saw blades. They are particularly suitable for production sawing all steels including stainless steel and the harder alloys, but are not much superior to carbon steel saw blades in cutting many non-ferrous materials. Being less flexible than carbon steel they tend to fatigue more readily if over stressed by bending. High speed saw blades cannot be satisfactorily welded with standard butt-welding equipment and therefore are not generally used for internal contour sawing.

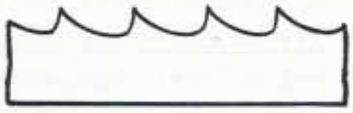
BI-METAL SAW BLADES have high speed steel teeth electron beam welded to a carbon steel band. In this way, the bi-metal saw blade combines the flexibility and welding characteristics of carbon steel with the cutting qualities of high speed steel. The long tool life and fast cutting rates

attainable usually make this type of saw blade economic for production sawing most steels and alloys.

TOOTH PITCH is important if optimum blade performance is to be obtained. Tooth pitch is determined mainly on the basis of material thickness and to some extent on material hardness. For a given material thickness, a tough or abrasive material will require more teeth in engagement than a soft ductile one. Too many teeth in engagement will decrease the tooth loading to the point where the teeth cannot penetrate the material and so skid across the cutting face and the heat generated by friction due to this rubbing action will cause the cutting edges to break down. It is a common error, especially where work hardening materials are concerned, to increase feed pressure so as to make the saw teeth bite under these conditions. This practice will produce a ragged inaccurate cut and rapidly destroy the saw blade.
Where there are insufficient teeth in engagement however, they can penetrate the material too quickly to produce a well formed chip. The stubby chip so produced leaves an inclined face where it breaks away from the cutting face and so causes the succeeding tooth to bounce. When this condition is reached, the uneven penetration of the teeth set up periodic vibrations in the form of saw blade chatter. Persistant sawing under these conditions can dull the teeth by impact and in extreme cases, cause the tips of the teeth to break away.
The chip produced by each tooth remains trapped in the gullet until it emerges from the underside of the workpiece. Therefore as the material thickness increases, the gullet must accommodate a larger chip. Considerable heat is generated if the chip is compressed into insufficient gullet space and with ductile materials, such chips tend to become welded to the teeth resulting in seizure or breakage of the saw blade.

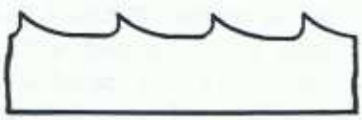
TOOTH FORM refers to the profile of the tooth. Metal cutting bandsaw blades are generally manufactured with one of three basic forms, namely, Regular, Skip, or Hook tooth form. Terminology varies amoung saw blade manufacturers and these may be otherwise referred to as Precision, Buttress, and Claw tooth respectively.

REGULAR TOOTH saw blades are the most common in use because the zero front rake and well rounded gullet present a robust tooth with good shock resistance and work penetration properties. It will produce accurate fine finish work in steel and most medium hard materials but tend to clog when used on soft or ductile alloys. Standard pitches are 6,8,10,14,18,24 & 32 teeth per inch.

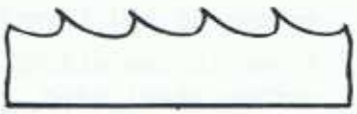


REGULAR TOOTH

SKIP TOOTH form is similar to the regular tooth form but alternate teeth are omitted, a design which allows greater gullet capacity without unduly weakening the body of the blade.
Providing the thickness of the material permits, a skip tooth saw blade will give best performance on aluminium and copper alloys. Fast economical sawing of hardwoods and plastics are possible with this type of saw blade. Standard pitches are 3,4 & 6 teeth per inch.



SKIP TOOTH



HOOK TOOTH

HOOK TOOTH form has positive front rake which considerably assists work penetration and hence produces faster cutting times on harder materials. The coarse pitch and large gullets associated with this type of saw blade make it particularly suitable for sawing deep sections. It is not recommended for use on abrasive materials. Standard pitches are 2,3,4 & 6 teeth per inch.

TOOTH SET is the angling of the saw teeth so that the tips protrude beyond the body of the saw blade. The width of the saw cut produced provides the working clearance necessary for the body of the saw blade and permits some degree of steering to negotiate curves.

STANDARD SET teeth are set alternately to the left and to the right, a style which is popular for cutting soft materials and wood.

RAKER SET saw blades have one tooth set to the left and one tooth set to the right followed by one unset tooth. This style of set is widely used and is to be preferred for contour sawing.

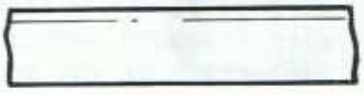
RAKER SET

WAVY SET saw blades have the teeth alternately set to the left and right in groups or waves. Wavy set saw blades are ideal for sawing tubes and very thin sections as the progressive set reduces the shock load on individual teeth. With this formation of tooth set however, relatively few teeth are cutting at the side of the kerf and therefore there is some tendency for the saw blade to jam when sawing abrasive materials.

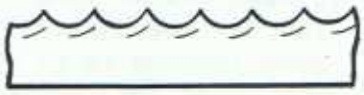
WAVY SET

SAW GAGE is the actual thickness of the body of the saw blade. Some makers produce special gage saw blades for specific purposes but generally saw blades up to and including ½" wide are .025", ⅝" and ¾" wide are .032", and 1" wide are .035" gage thickness.

Knife edge bands are suitable for cutting soft material such as woven fabrics, sponge, rubber, and corrugated cardboard. Where the nature of the material is fibrous and difficult to sever, wavy or scalloped edge blades are better as the teeth provide a more positive cutting action. Typical applications are cutting cork, filter elements, felt and composite materials such as transformer coils. Because these bands separate the material, no dust or swarf is produced and a smooth finish is usually obtained.



KNIFE EDGE BAND



SCALLOPED EDGE BAND

WAVY EDGE BAND

Most plastics can be sawn with a metal cutting saw blade. Very little difficulty should be experienced in sawing thermosetting materials, although some have an abrasive nature which shortens the life of a saw blade. Lubricant should not be used with this type of material. Heat generated by sawing friction cause thermosetting materials to become clogged by swarf, particularly when a blunt or fine pitch saw blade is used. Water may be used as a lubricant in most cases, but where there is a risk of water absorption as in the case of insulating materials, the best recourse is to experiment with the lower blade speeds.

SECTION 72

BANDSAWING PRACTICE.

The work tables of 216H and 316H Models have hydraulic power feed which permits consistant controlled sawing without physical effort by the operator. The work tables of 216 and 316 Models are equipped with a hand feed mechanism which allows substantial feed force to be applied with only light hand pressure.

In both cases the table feed can exert considerable force and care must be taken not to overload the saw blade. Evidence of undue force in feeding are indicated by the tendency for the saw blade to bow in the cut, accompanied possibly by vibration and chatter.

Particular care is necessary where a corner or thin section is presented to the saw blade as the saw teeth may straddle the work and hence be torn from the blade.

Good iron castings can be sawn with ease, but a saw blade can be prematurely dulled by coming into contact with sand inclusions or a chilled face. The same may also apply to flame cut or welded steel parts and it is then desirable that the hard spots be removed by fettling to provide a start for the saw blade.

A workpiece that does not sit firmly on the table must be supported by packing to eliminate rocking. Support must be given adjacent to the line of cut if there is any possibility of the kerf closing in and so trapping the saw blade due to the action of the cutting forces involved.

The sliding table offers the facility of positively locating the workpiece relative to the saw blade. Thus where many identical parts are to be machined, a fixture can be provided to support, locate and clamp the work with the minimum of time and effort.

Dimensional accuracy is very much depenedent upon the skill of the operator and working conditions. As a general rule, a tolerance of $\pm$.03 inches is typical for contour sawing one inch thick low carbon steel. A greater accuracy is possible but this usually demands above average operating time and skill according to the complexity of the operation.

Surface finish will also vary with job conditions, being less controllable with freehand sawing than with straight sawing under hydraulic feed.

Deflection of the tooth set can produce a geometric wave pattern under certain conditions but indentation is minimal and the pattern can usually be eliminated by reducing the feed. Apart from this phenomenon, surface finish better than 300 micro-inches can be obtained.

The diverse nature of work and materials encountered from day to day in some jobbing shops demand a wide range of saw blades to meet all contingencies. The usual plan is to stock saw blades to deal with anticipated routine work and order saw blades for unusual jobs as required. Under these conditions it sometimes arises that the optimum saw blade is not immediately available for an urgent job. Here it is necessary to use the nearest alternative available and provided the substitute is a reasonable choice, most jobs can be satisfactorily completed. The following notes offer some guide for action in these circumstances, but the limitations must be recognised and the inevitable loss of efficiency and saw blade life accepted.

For thick materials, a wide saw blade with slightly finer pitch is to be preferred to the correct pitch in a narrow saw blade.

For thin materials, use next finer pitch regardless of width.

If saw blade is too narrow for depth of cut, reduce feed and if necessary, increase tension.

BANDSAWING PRACTICE (CONTINUED) .

Where saw blade pitch is too fine, increase saw blade speed.
If pitch is too coarse for thin material, try stacking or make up thickness with waste material.
A curved cut cannot be made with a saw blade that is too wide, but it may be possible to produce small internal radii by drilling, and external radii by making a series of straight or curved cuts.

BLADE WIDTH FOR CONTOUR SAWING.

For contour sawing the width of the saw blade must be chosen with regard to the smallest radius to be sawn, thus a small radius will demand the use of a narrow saw blade. The beam strength and permissible tension decreases rapidly for narrow saw blades and it therefore follows that narrow saw blades are particularly sensitive to excessive stress which will cause stretching and deformation at low speed or premature breakage through fatigue at high speed. Saw blades which fail through abuse of this kind are useless and must be discarded although the teeth may be still in good condition. It is impossible to be precise as to the smallest radius any given saw blade will cut as so much depends on job conditions and the skill of the operator.
The Saw Blade Width Selection Chart below offers a basic guide on this point. Several drilled holes at strategic points around the contour may be necessary to negotiate small radii or cut to a sharp corner.

SAW BLADE WIDTH	1/8"	3/16"	1/4"	3/8"	1/2"	5/8"	3/4"	1"
MINIMUM SAWING RADIUS	5/16"	5/8"	1"	1½"	2½"	4½"	5¾"	7½"

COOLANT.

The purpose of coolant in the accepted sense is two fold, namely to conduct away heat and provide lubrication. Coolants vary a great deal in chemical composition according to whether cooling or lubrication is the main requirement.
The use of coolant for many bandsawing operations is recommended to prolong saw blade life and improve machineability. It is a feature of the vertical bandsawing process that only a minimal amount of material is reduced to chips, the bulk of waste being removed in one or more large pieces as convenient. This means that a relatively small amount of heat is generated in the sawing process and therefore flood coolant is not generally necessary.
The necessary quantity to be applied is quite small and generally need be no more than can be evaporated and carried away with the chips. Pools of liquid forming on the job and work table serve no useful purpose and usually indicate that excessive coolant is being used.
STARCOOL is a soluble cutting oil specially formulated for air/spray application on vertical bandsawing machines and by varying the dilution, will prove suitable for most job requirements. A dilution of one part STARCOOL with twenty parts of water is generally suitable for free machining and low carbon steels, low alloy steels and most non-ferrous alloys. Machineability of harder materials such as high alloy steels and stainless steels can be improved by using a richer mixture of ten to fifteen parts water.
For details on Coolant Equipment see Section on Optional Extra Equipment.

SECTION 72

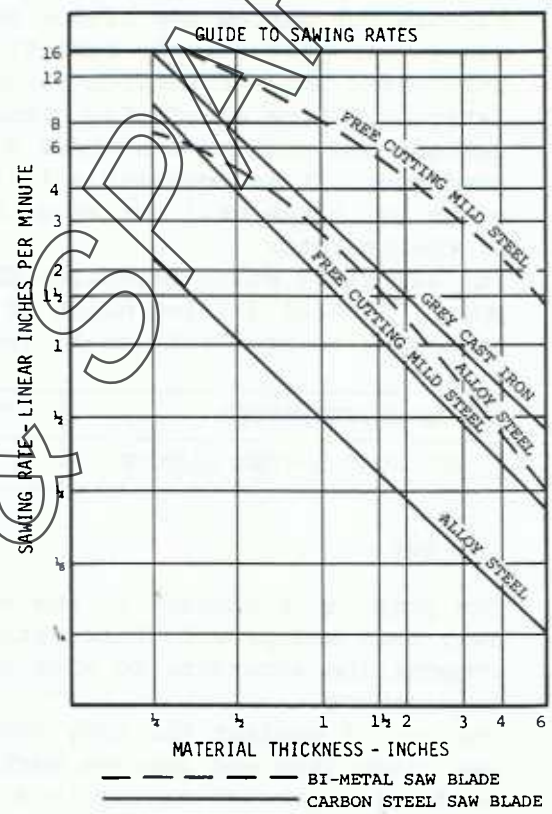
JOB COSTING.

The success of a bandsawing operation is determined by the accuracy, finish, blade cost and operating time involved. It is usually possible to improve on one of these factors at the expense of the others, and this may be expressed in general terms as follows :-

Maximum saw blade life : Medium saw blade tooth pitch, speed and feed.
Minimum sawing time : Coarse tooth pitch, fast speed and heavy feed.
Fine accurate finish : Fine tooth pitch, fast speed and light feed.

The foregoing must be interpreted with discretion as there are limits to which the factors involved can be varied.

The Guide To Sawing Rates Chart will give some indication of sawing rates under average conditions. The term "Alloy Steel" covers a wide range of steels, some of them being almost unmachineable with a carbon steel saw blade. In such cases a bi-metal saw blade must be used and the graph for carbon steel saw blades is not applicable. The importance of saw blade life is often over emphasised as its cost is an obvious item. Less obvious is the associated operating cost for labour and plant, and this is usually the prime factor in determining the overall cost per cut. Providing that accuracy and surface finish is acceptable, the saw speed and feed which produce fast cutting times with medium saw blade life will prove more economic than medium cutting times with long saw blade life. An example of the type of chart shown below can be used to establish optimum operating conditions from experimental data. Only one factor at a time should be varied for each series of tests, allowing each test saw blade to complete its working life under fixed conditions. Usually up to four tests will pin point the minimum operating costs with reference to any factor. This method of cost analysis can show substantial savings where long run production work is concerned.



JOB

	TEST BLADE 1	TEST BLADE 2	TEST BLADE 3	TEST BLADE 4
TYPE				
TOOTH FORM				
TOOTH PITCH				
SAW SPEED				
TIME PER CUT				

OPERATING COST PER CUT				
SAW BLADE COST PER CUT				
TOTAL COST PER CUT				

COMMON SAWING PROBLEMS.

BLADE WANDERS FROM TRUE LINE :

Excessive feed pressure.
Blade teeth dull or of too fine pitch.
Guide inserts not controlling blade through wear or incorrect adjustment.
Blade tracking incorrect.
Loss of set to one side of saw teeth.

PREMATURE BLADE BREAKAGE :

Excessive feed pressure, and/or too much blade tension.
Worn or incorrectly set guides.
Joint improperly welded and annealed.
Blade too wide for curved cut.
Bandwheels worn.
Blade teeth of too fine pitch.

BLADE BOWS IN DEEP CUT :

Excessive feed pressure.
Blade teeth dull or of too fine pitch.
Insufficient blade tension, and/or blade too narrow for depth of cut.
Blade running off at start of cut.

BLADE TEETH DULL RAPIDLY :

Insufficient feed pressure.
Guide inserts snagging set of teeth.
Blade speed too fast, and/or blade pitch too fine.
Hard spots in material.

TEETH TORN FROM BLADE :

Excessive feed pressure.
Gullets of teeth loading.
Blade speed too fast, and/or blade pitch too coarse.
Material pressure welding to teeth.

BLADE DEVELOPING TWIST :

Excessive feed pressure.
Guide inserts snagging blade.
Blade too wide for radius of cut.
Excessive blade tension.
Blade not tracking correctly.
Loss of set to one side of saw teeth.

BLADE VIBRATES IN CUT :

Workpiece not properly seated or securely held.
Blade speed too fast, and/or blade pitch too coarse.
Insufficient blade tension.

DIE MAKING.

By careful drilling it is possible to produce a punch and die from one piece of material, the waste from the die aperture forming the punch, see Fig.1. The chart gives recommended saw blade width, hole sizes, and angles for die thickness of ½" - 3".

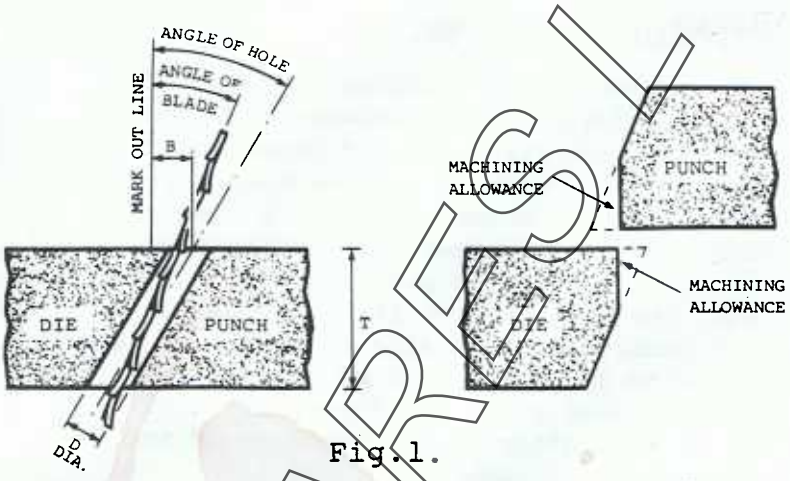


Fig.1.

DIE THICKNESS T.	½"	¾"	1"	1¼"	1½"	1¾"	2"	2½"	3"
BLADE WIDTH B.	1/8"	1/8"	1/8"	3/16"	3/16"	3/16"	1/16"	¼"	¼"
ANGLE OF HOLE	37°	26½°	20½°	24°	20½°	18°	15½°	16½°	14°
HOLE DIA. D.	3/16"	3/16"	3/16"	9/32"	9/32"	9/32"	9/32"	3/8"	3/8"
ANGLE OF BLADE	26½°	18½°	14°	16½°	14°	12°	10½°	11½°	9½°

For other combinations of die thickness and saw blade width calculate the machining geometry as follows :-

Let T = Die Thickness
B = Width of selected saw blade
Then :- Starting hole diameter = $\frac{3B}{T}$
Starting hole center to mark out line = B
Tangent of starting hole angle = $\frac{3B}{T}$
Tangent of saw blade angle = $\frac{2B}{T}$

By following the foregoing formulae, a machining allowance equal to 75% of the saw blade width will be obtained. This allowance may be reduced by slight alteration of the drilling and sawing angles.

TANGENTS OF ANGLES.										
TANGENT	.017	.035	.052	.070	.087	.105	.123	.140	.158	.176	.194
ANGLE	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°
TANGENT	.213	.231	.249	.268	.287	.306	.325	.344	.364	.384	.404
ANGLE	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°
TANGENT	.424	.445	.466	.488	.510	.532	.554	.577	.601	.625	.649
ANGLE	23°	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°
TANGENT	.675	.700	.727	.754	.781	.810	.839	.869	.900	.933	.966
ANGLE	34°	35°	36°	37°	38°	39°	40°	41°	42°	43°	44°

SECTION 74

BUTT-WELDING SAW BLADES.

The process of butt-welding consists of clamping the saw blade between two sets of jaws, one set fixed and the other set moveable. The ends of the saw blade are heated by the passage of a heavy electric current and at the same time, they are forced together by a pre-determined amount under spring pressure. The blade welding unit enables the operator to rejoin broken blades or to produce new bands from bulk coil strip as required. Internal contours may be sawn after passing one end of the blade strip through a starting hole, then making the joining weld, see Fig.2.

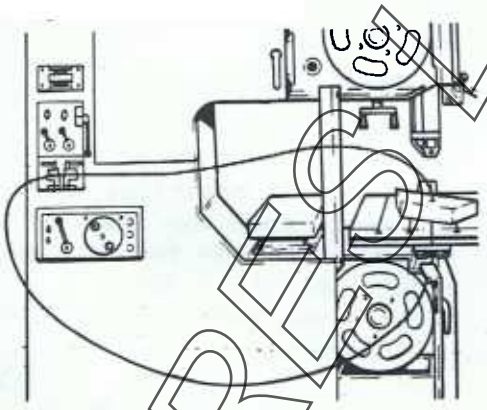


Fig.2.

PREPARING THE SAW BLADE.

Blade Lengths - 216/216H : Minimum 3425mm, 135" ; Maximum 3590mm, 141".
316/316H : Minimum 4570mm, 180" ; Maximum 4645mm, 183".

Cut the saw blade to length (see above) using the blade shear attached to the front of the welder (see Fig.3). The shear is operated by moving the handle upwards. With coarse pitch blades, the blade should be sheared in line with the tooth point in order to maintain a uniform tooth pitch after welding. It is important that the ends of the blade are sheared square in both planes. To achieve this the saw blade is to be inserted in the shears with the teeth facing to the front. The back edge of the blade must seat against the back of the shears and against the alignment stop. Thoroughly clean each end of the blade with emery for a distance of 1½" until bright metal shows over the whole width of the blade. Make sure the clamping jaws of the welder are free from dirt and grease.

WELDING.

A diagram of the butt-welder unit is given in Fig.3. Adjust the welding current, up-set way and up-set pressure according to saw blade width. Place the prepared ends of the blade into position by means of the clamping screws, making sure that the two ends of the blade butt together at a point midway between the jaws. In order to avoid damage to both jaws and blade, it is important that the blade teeth face forward against the front stops. Turn the up-set way lever to the position marked WELD and hold it there until the weld is finished. The current is switched off automatically at the completion of the welding operation. After welding, slacken the clamping screws.

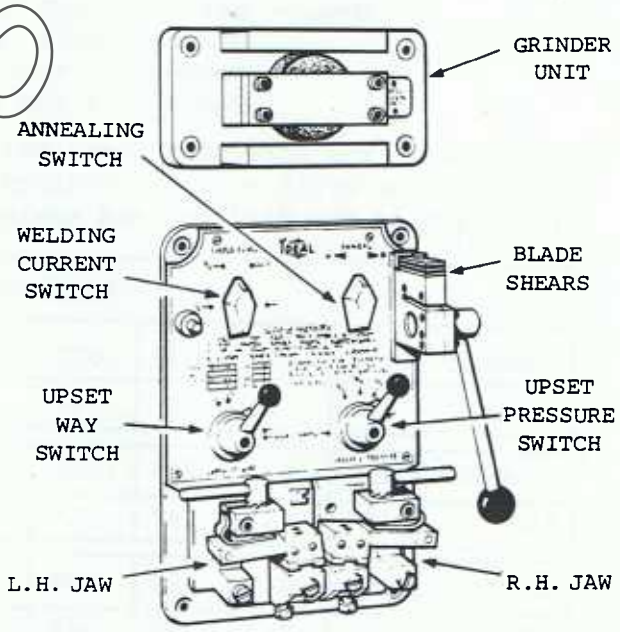


Fig.3.

CAUTION :
Sparks may fly during welding, therefore it is advisable to protect the face.

ANNEALING.

A join produced by welding alone is brittle and would break after very little service. In order to overcome this the blade join must be annealed by a second operation. Set the up-set way switch to the ANNEAL position. Re-clamp the blade with the weld midway between the jaws. Press the anneal button continuously until the weld is a dark cherry red. This process should be repeated a few seconds at a time letting the heat go slowly. Gradually reduce the length of time that the button is depressed as the process proceeds.

FINISHING.

The excess weld flash must be removed by grinding, some care being taken to maintain a uniform blade thickness. The gullets of the teeth adjacent to the weld should be cleaned out as necessary. After the weld has been dressed in this fashion, anneal the joint to a pale blue color.

POSSIBLE FAULTS.

If the weld has run too much or even shows holes, then the proportion of up-set pressure to welding is incorrect. In such a case increase the up-set pressure or decrease the welding current, it may be necessary to do both. If however, the up-set pressure is too great and the welding current too small, the weld will have the appearance of loose layers.
NOTE : Operating characteristics may vary slightly according to supply voltage, therefore it may be necessary to use an alternative setting in order to achieve optimum results.

CARE OF THE BUTT-WELDING UNIT.

The most important part of the care of the welder is the careful handling of the bronze jaws. It is impossible to obtain satisfactory welds with dirty or uneven jaws. Any drop of weld, or dirt which may have entered the jaws should be removed immediately. From time to time check the clamps for uniform clamping pressure as follows :- Place in position as for annealing, a clean smooth band (saw blade with set of teeth removed) as wide as the jaws. Upon operation of the annealing button, the band should become simultaneously and uniformly red over the whole width. If this is not the case, inspect the clamps for any foreign matter which may have entered. If the jaws and pressure faces appear clean, it will be necessary to dress the pressure faces where the band heats most quickly bearing in mind that the band heats less quickly where the clamping pressure is least. The pressure faces should be dressed in line with fine emery wrapped around a piece of wood. Take care to thoroughly clean away emery dust. The bronze jaws should not be filed. The moving jaws are mounted on a sensative ball bearing track and therefore should not be forced in any way.

CARE OF THE GRINDING UNIT.

The grinding motor will produce excessive whine if allowed to run with an unbalanced wheel. Dress new wheel upon replacement and if necessary, adjust wheel clamping washer to run eccentric in order to improve dynamic balance. Dress periphery of wheel occasionally to remove embedded swarf.

Wheel size : 63 mm. Dia. x 15 mm. Wide x 10 mm. Bore
Grade : A 46 PV
Max. Speed : 3000 r.p.m. Synchronous (50Hz supply)
Max. Speed : 3600 r.p.m. Synchronous (60Hz supply)

AIR/SPRAY COOLANT KIT.

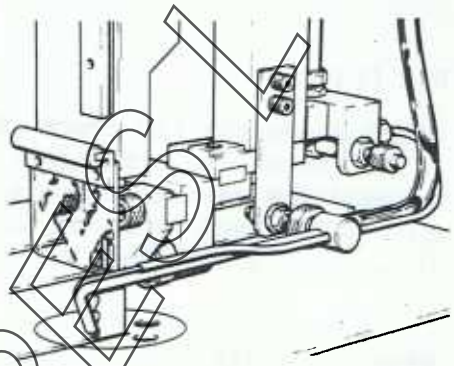


Fig.1.

Fig.1 shows the air/spray coolant kit, which may be fitted to machines Serial No. 51600 onwards. The system is supplied as a kit of parts for user installation (Part No.PK92 - 316/316H Models; Part No.PK93 - 216/216H Models). A pump, driven from the main motor, circulates the coolant around a loop system, and from this is drawn the required amount for application. Unused coolant is re-circulated through a two gallon tank thereby ensuring that the solution remains emulsified, and efficient filtration prevents blockage of the coolant control valve and nozzle. The equipment injects a precisely controlled quantity of coolant into an air stream directed at the saw blade. The spray nozzle should be positioned as close as is convenient to the saw blade with the air jet impinging on the teeth at the point of entry in the workpiece. Apart from cooling and lubricating the saw teeth, the air/spray assists in cleaning the saw gullet and removes swarf ahead of the saw cut to facilitate following a marked line. It is a feature of this system that the coolant is delivered by low pressure air in the form of globules which are too large to remain airborne.

IMPORTANT : COOLANT IN THE TANK MUST BE KEPT ABOVE THE LEVEL OF THE FILTER. THE FILTER SHOULD NOT BE ALLOWED TO BECOME EXPOSED TO THE ATMOSPHERE.
CAUTION : DILUTED STARCOOL SOLUBLE CUTTING OIL IS THE ONLY RECOMMENDED COOLANT. USE OF OTHER OILS MAY CAUSE DIFFICULTIES IN OPERATION AND IN SOME CASES, DAMAGE TO PARTS OF THE MACHINE.

CIRCLE CUTTING ATTACHMENT.

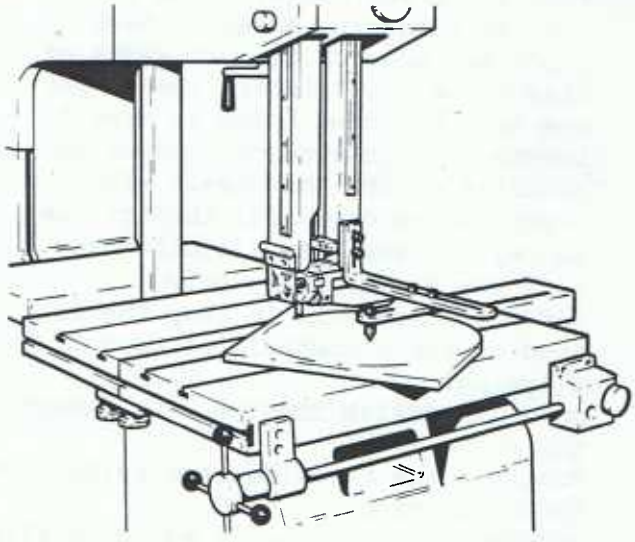


Fig.2.

Fig.2 shows the circle cutting attachment (Part No.SP395) in use on a machine, which facilitates the production sawing of circular blanks up to 18" dia. The unit is easily fitted to the tool post and thus may be raised and lowered when feeding blanks without disturbing the setting of the location pin. A drilled or punched location point will be required in each blank, the location being positioned at a distance equal to the sawing radius from one edge. Sufficient material should be allowed on the other three sides of the blank to prevent the saw blade emerging from the cut until the full circle has been completed. Select the saw blade width according to the radius to be sawn (see Section on Sawing Practice). The location pin must be set to lie tangential to the saw blade otherwise blade wander will result. If the saw blade tends to cut away from a true circle, the pin position is incorrect, or possibly the saw blade is too wide.

RIP FENCE.

Fig.3 shows the rip fence (Part No. SP388) in use on a machine. It can be used for making accurate parallel cuts using hand feed, or as a work stop using power feed.

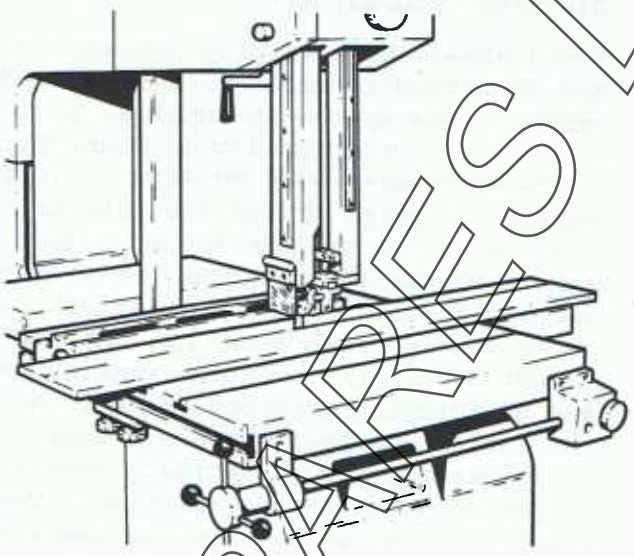


Fig.3.

BANDFILE GUIDE.

Fig.4 shows the bandfile guide (Part No.SP394) in position on a machine, which adapts the machine for power filing. Bandfiling presents an economic method of production machining straight and contour faces. Because there is no tendency for the file to rock, wide faces can be finished to fairly close tolerances. Bandfiles consist of short lengths of file sections attached to a flexible steel band which has a joint for unlocking and re-joining, thus permitting the filing of internal contours. The guides will accomodate standard files of ¼",⅜", or ½" width.

To set up machine for bandfiling :- Remove the saw blade, blade guides and table insert. Assemble back guide and spacers to suit width of file to be used. Insert the support arm into the same holes as used to locate the blade guides. Mount the bandfile on the bandwheels with the teeth facing downwards through the table, and track in a similar way to a saw blade. Apply only sufficient tension to keep the file band on the bandwheels without it slipping.

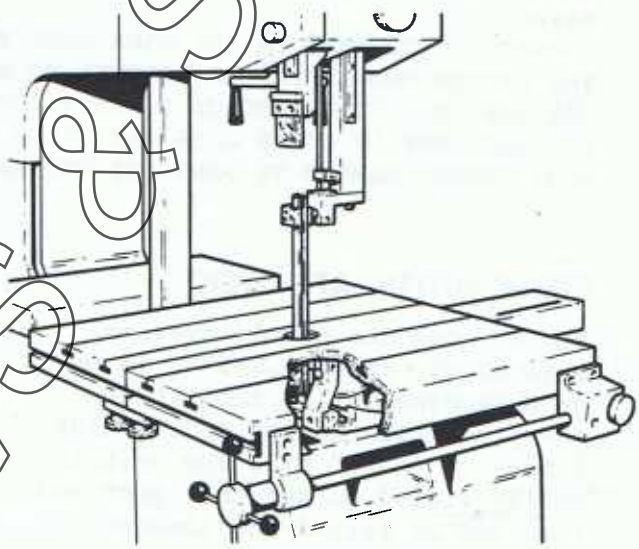


Fig.4.

NOTE : EXCESSIVE TENSION WILL DAMAGE THE BAND.

Position the bandfile back guide just clear of the band. Fit special table insert provided.

WARNING : An incorrectly adjusted file guide may prevent the file segments from interlocking in the correct manner and thus result in the segments being torn from the backing band. It is important that a new bandfile is only lightly loaded when first used in order to allow the file segments to bed down.

Use a filing speed of around 60 feet per minute (18 meters per minute) for die steel, and up to 120 feet per minute (36 meters per minute) for mild steel. Speeds in excess of 300 feet per minute (91 meters per minute) may damage the bandfile.

BANDFILE GUIDE (CONTINUED).

Embedded swarf should be periodically removed to prevent the workpiece being scored. This problem can be reduced by a light application of tallow or chalk. Care must be taken to avoid kinking the backing band in storage and for this reason, the bandfile should be stored in its original container when not in use.

ABRASIVE BAND GUIDE.

Fig.5 shows the abrasive band guide (Part No.SP393) set up on a machine. One inch wide abrasive bands are available in 40,80 or 120 grit and are ideal for a large variety of small finishing and deburring operations.
To set up the abrasive band guide :- Remove the saw blade, blade guides, and table insert. Assemble abrasive band guide into the same holes as used to locate the blade guides. Mount the abrasive band on the bandwheels, with the joint of band overlap (on the abrasive side) to face upwards from the table. Apply tension as for a ¼" wide saw blade. Align face of guide to back of band. Use highest blade speed available.

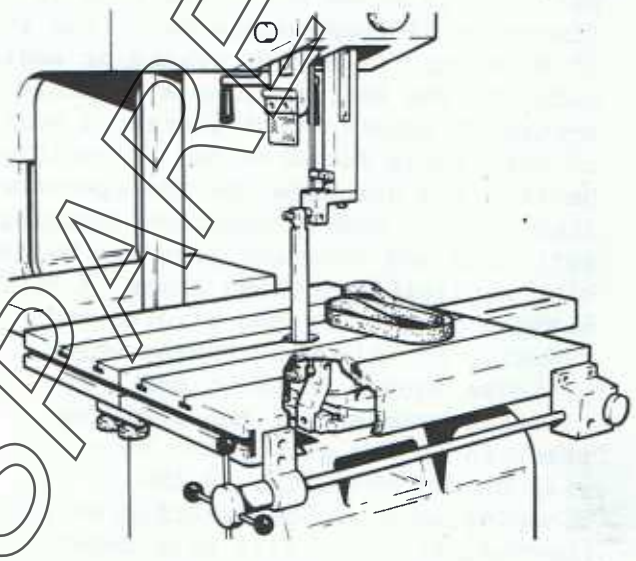


Fig.5.

CONTOUR WORK HOLDING KIT.

Fig.6 shows the contour work holding kit (Part No.PK64A) in use on a machine. The mechanical advantages offered by the hand feed mechanism of the sliding table can be used to some advantage in die making. The die block cannot be clamped to the work table in the usual way if contour sawing is involved as manipulation of the workpiece is necessary. In this instance, the table motion can be transferred by roller chain passing both around the workpiece and a jockey wheel attached to the rack cover at the rear of the table. By this method, the workpiece is steered by one hand and feed is applied by the other. Hold circular workpiece by wrapping the chain directly around the job. To prevent the chain slipping, saw a small slot in the periphery of the workpiece and insert a small piece of saw blade so as to engage with the chain.

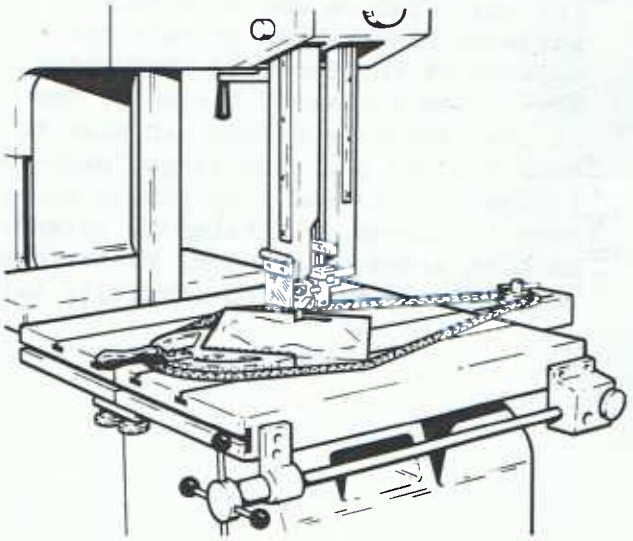


Fig.6.

UNIVERSAL WORK HOLDING KIT.

For dealing with standard shapes and sections, a universal work holding kit (Part No.PK70) is available for use on a sliding table. Fig.7 shows a typical set-up constructed from standard parts of the kit to hold round bar. This type of fixture will accommodate bars from ¼" to 5" diameter for either square or angled cutting. The kit provides a flexible system of construction whereby a variety of work table fixtures can be rapidly devised and assembled by the operator. By this method, many production notching, splitting and trimming jobs can be tackled with negligible tooling costs. A typical example of this is the slicing and trimming of thin wall tubing which presents both a location and clamping problem. If the clamping pressure is too great, the tube will be deformed. Should the clamping pressure be insufficient, however, the tube will slip under cutting pressure and probably damage the saw blade.

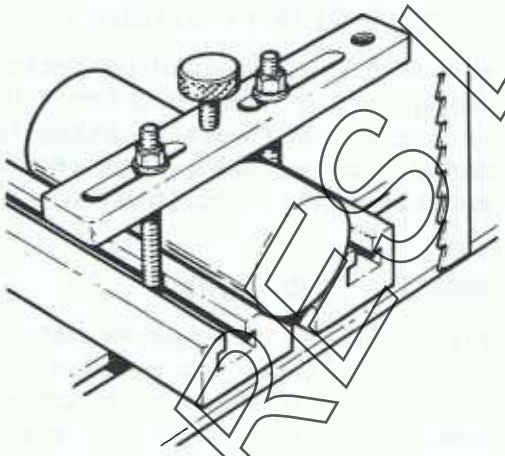


Fig.7.

Fig.8 shows a simple fixture to locate and clamp formed pipe bends for an end trimming operation. This low cost fixture was made from a hardwood block bored to suit the outside of the tube and then split across the center of the hole. One of the halves is reduced in size to form a clamp pad. The larger piece forms the base of the fixture and is fitted with an end stop pin to determine the trimmed length. The break off burr is almost eliminated by extending the base so as to support the tube on both sides of the cut. Variations of this type of fixture will eliminate distortion when sawing irregular extruded sections.

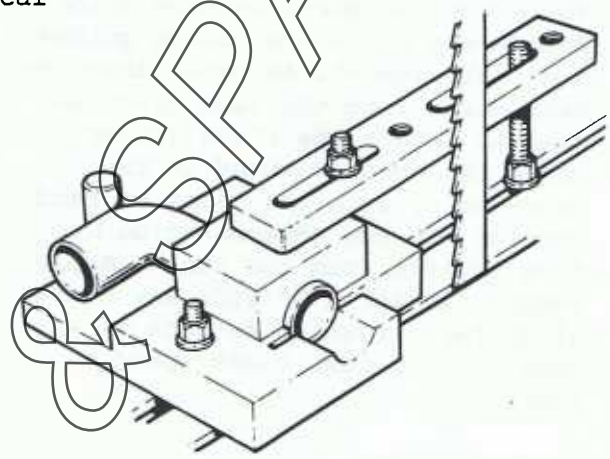


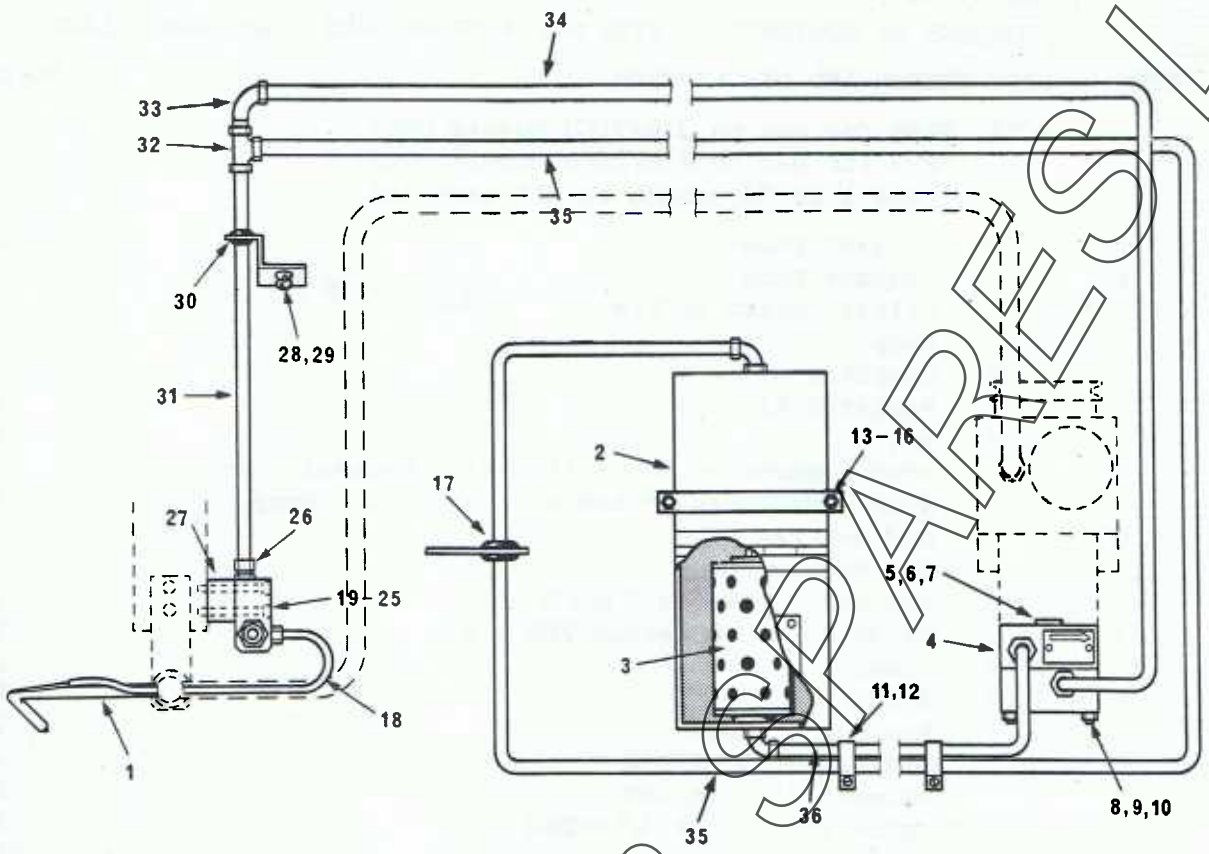
Fig.8.

AIR/SPRAY COOLANT KIT - PART Nos.PK92/PK93

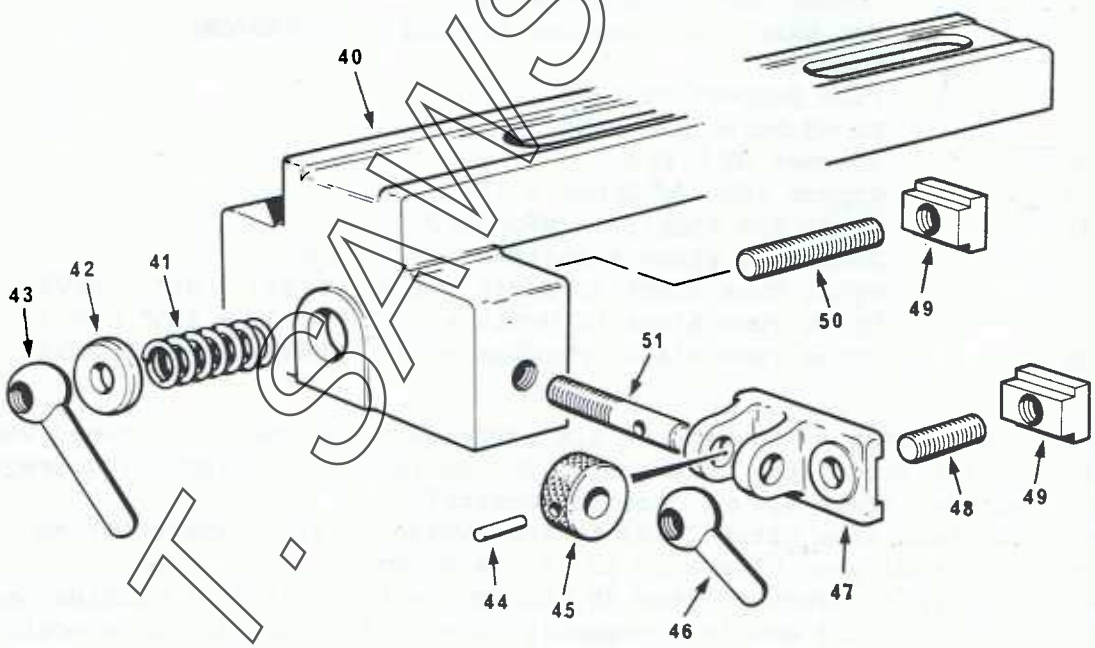
(FOR USE IN CONJUNCTION WITH PK174 CHIPBLOWER - SEE PARTS LIST).

ITEM	PART NUMBER	AND DESCRIPTION	No.OFF
	NOTE : PK92 for use on 316/316H Models ONLY. PK93 for use on 216/216H Models ONLY. Items 1 to 33 common to all machines.		
1	SP679	Coolant Tube	1
2	SP519	Coolant Tank	1
3		Filter	1
4	SP532	Pump	1
5	3588	Coupling	1
6	3589	Register Ring	1
7	3608	Key	1
8	3609	Stud - Machines NOT fitted with hydraulic pump	2
	3636	Stud - Machines fitted with hydraulic pump	2
9		Std.Nut	2
10		Std.Washer	2
11		Tubing Clip	2
12		Rd.Hd.Screw - Recessed	2
13	3602	Clamp	1
14	3604	Stud	2
15		Std.Nut	2
16		Std.Washer	2
17		Grommet	1
18		Nylon Tube Black	1
19	3633	Manifold	1
20		Metering Valve Simplifix	1
21		Soc.Cap Screw	2
22		Par.Male Stud Coupling	1
23		Nut	1
24		Ferrule	1
25		Copper Tube	1
26		Par.Male Stud Coupling	1
27	3632	Spacer	1
28	3634	Tube Support Bracket	1
29		Rd.Hd.Screw	2
30		Grommet	1
31		Copper Tube	1
32		Equal Tee	1
33		Standpipe Elbow	1
34		Nylon Tube Black	1
35		Nylon Tube Black	1
36		Nylon Tube Black	1

Secure pump (Item 4) to rear of air compressor (or hydraulic pump, where fitted) with studs etc. (Items 8,9 & 10) making sure the coupling, register ring and key (Items 5,6 & 7) locate correctly.
Secure coolant tank (Item 2) alongside hydraulic tank (where fitted) with clamp and studs etc. (Items 13 to 16) as shown.
Use tube support bracket (Item 28) to locate tube (Item 31) inside machine body after securing manifold assembly (Items 19 to 25) to guide post, and replacing chipblower pipe (Part No.4930 - PK174, see Parts List), with coolant tube (Item 1).
Connect nylon tubes (Items 34, 35 & 36) as shown.



AIR/SPRAY COOLANT KIT



RIP FENCE

RIP FENCE - PART No.SP388

ITEM	PART NUMBER	AND DESCRIPTION	No.OFF
40	3055	Fence	1
41	2575	Spring	1
42	1114	Special Washer	1
43	1143	Locking Handle	1
44		Mills Pin	1
45	1112	Adjustment Collar	1
46	1111	Locking Handle	1
47	1206	Bracket	1
48	3229	Stud	1
49	2842	Tenon Nut - Small	2
50	2841	Stud	1
51	1113	Adjustment Screw	1

CIRCLE CUTTING ATTACHMENT - PART No.SP395

60	SP396	Arm	1
61	2543	Center Pin	1
62	3138	Bracket	1
63		Std.Washer	5
64		Soc.Cap Screw	3
65		Soc.Cap Screw	2

ABRASIVE BAND GUIDE - PART No.SP393

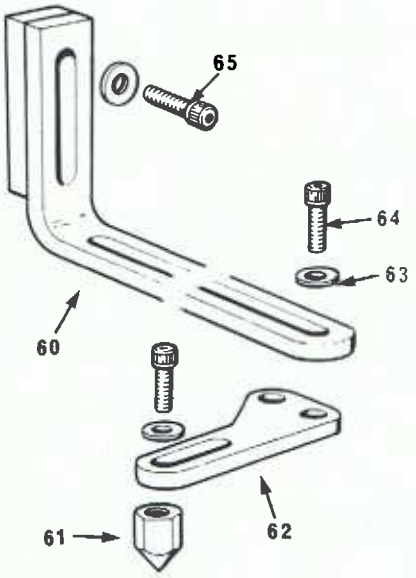
70	3132	Top Mounting Bracket	1
71	3135	Support Arm	2
72		Std.Nut	2
73		Std.Washer	2
74	2426	Backing Plate	1
75		Soc.Cap Screw	1
76		Soc.Cap Screw	1
77		Soc.Cap Screw	1
78		Soc.Cap Screw	1
79	3131	Bott m Mounting Bracket	1

BANDFILE GUIDE - PART No.SP394

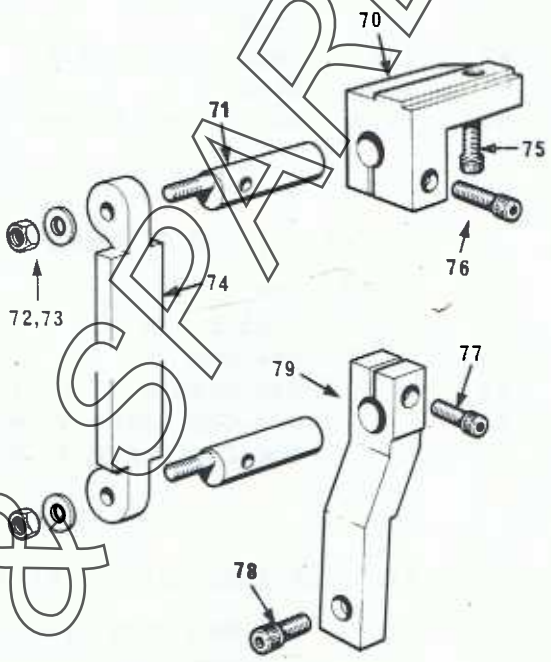
90	3132	Top Mounting Bracket	1
91		Soc.Cap Screw	1
92		Soc.Cap Screw	1
93		Std.Nut	4
94	3133	File Guide Bracket	2
95	1984	Edge Guide	4
96		Soc.Cap Screw	4
97	3134	Table Insert	1
98		Soc.Cap Screw	1
99		Soc.Cap Screw	1

(CONTINUED)

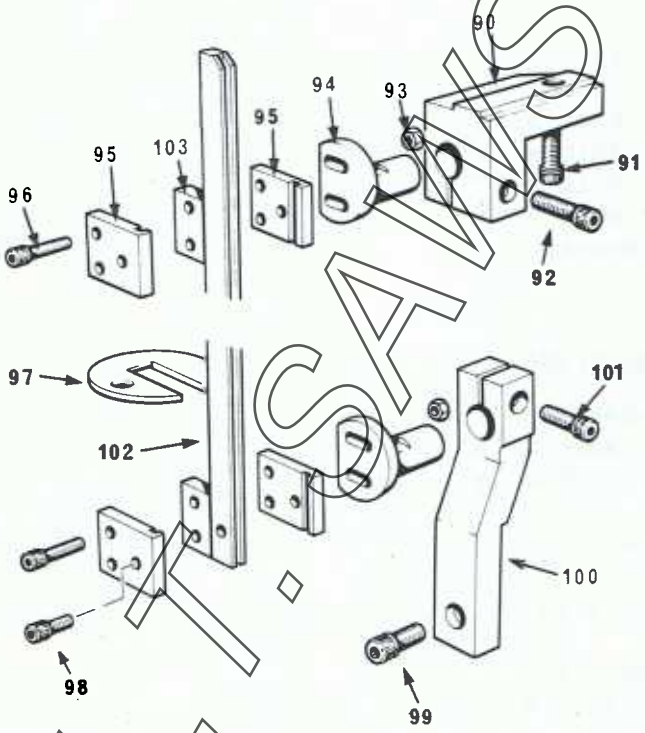
SECTION 76



CIRCLE CUTTING ATTACHMENT



ABRASIVE BAND GUIDE



BANDFILE GUIDE

BANDFILE GUIDE - PART No.SP394 - CONTINUED

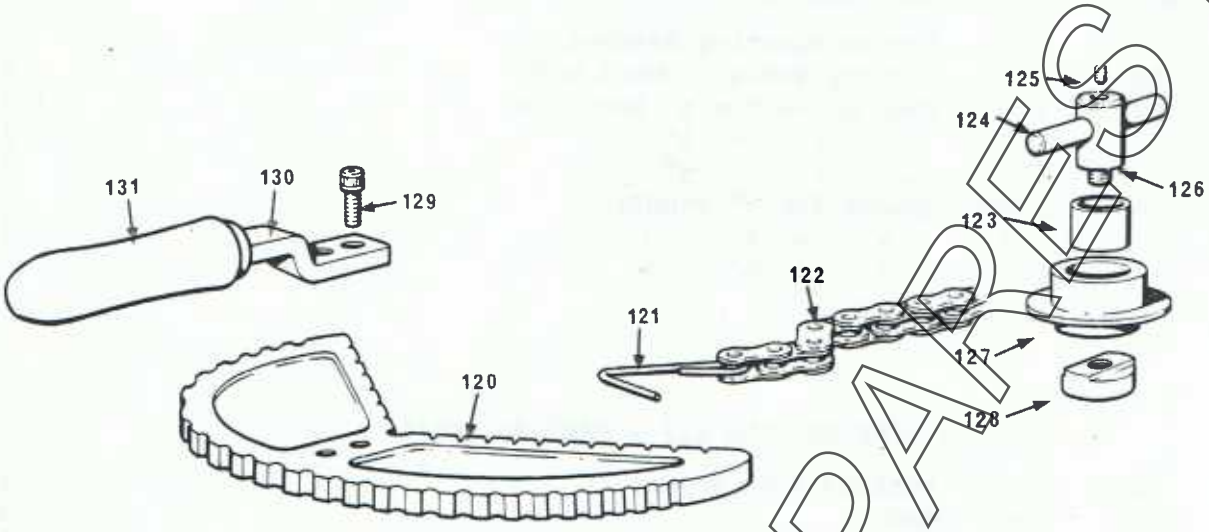
ITEM	PART NUMBER	DESCRIPTION	No.OFF
100	3131	Bottom Mounting Bracket	1
101		Soc.Cap Screw	1
102	1989A	Band Guide for ¼" Bandfile	1
	1989B	" " " ⅜"	1
	1989C	" " " ½"	1
103	1990A	Spacer for ¼" Bandfile	1
	1990B	" " ⅜" "	1
	1990C	" " ½" "	1

CONTOUR WORK HOLDING KIT - PART No.PK64A

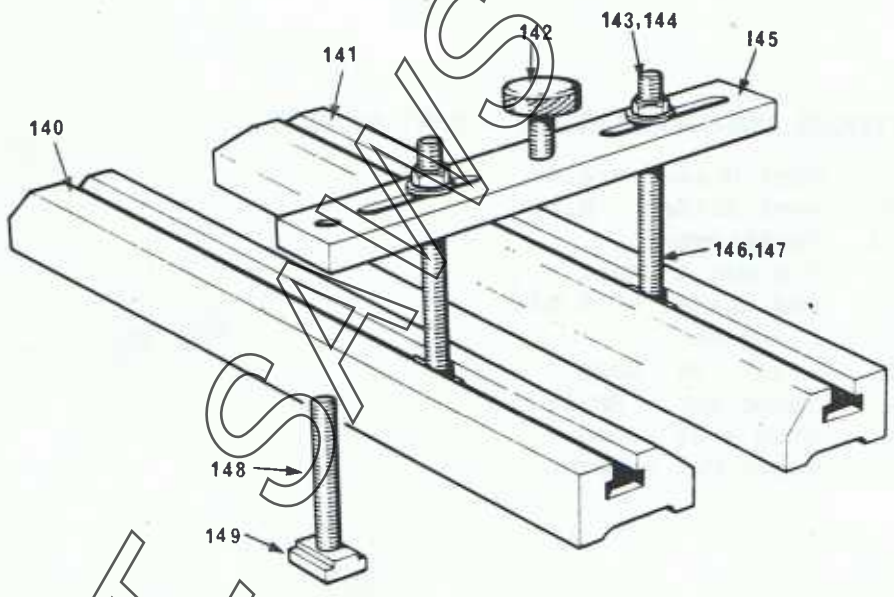
120	2008	Notched Work Holder	1
121	2863	Hook	1
122		Roller Chain	1
123		Compo Bush	1
124	2864	Tommy Bar	1
125		Soc.Grub Screw	1
126	2867	Spindle	1
127	2865	Flanged Pulley	1
128	2866	Spindle Nut	1
129		Soc.Cap Screw	2
130	2862	Handle Bracket	1
131		5" Pad Handle with Ferrule	1

UNIVERSAL WORK HOLDING KIT - PART No.PK70

140	2837	Work Holder - L.H.	1
141	2838	Work Holder - R.H.	1
142	2843	Thumbscrew	2
143		Std.Nut	12
144		Std.Washer	12
145	2839	Clamp Bar	2
146	2840	Stud - 5½" Long	4
147	2842	Tenon Nut - Small	4
148	2841	Stud - 2½" Long	6
149	3230	Tenon Nut - Large	4



CONTOUR WORK
HOLDING KIT



UNIVERSAL WORK
HOLDING KIT

GEARBOX ASSEMBLY - PART No.SP331

ITEM	PART NUMBER	DESCRIPTION	No.OFF
1	2651	Gearbox Housing	1
2		Soc.Cap Screw	2
3	2944	Output Shaft	1
4		Oil Seal	1
5		Ball Race Hoffmann LS11	1
6		Circlip	2
7		Soc.Cap Screw	4
8	2657	Dust Cap	1
9		Split Pin	1
10	2799	Baffle Plate	1
11	2659	Key	1
12		Needle Race	2
13		Circlip	2
14	2653	Final Drive Pinion	1
15		Needle Race	2
16		Std.Dowel	4
17	2660	Bridge	1
18	2654	Final Drive Gear	1
19		Circlip	1
20		Needle Race	1
21	2656	Intermediate Shaft	1
22		Steel Ball	1
23		Compression Spring	1
24		Mills Pin	1
25	1036	Liner	1
26	1044	Intermediate Gear	1
27		Rivet M.S.	8
28	1035	Clutch Plate	1
29	1024	Pin	1
30	1147	Key	1
31	3253	Layshaft	1
32	1027	Special Key	2
33	2658	Key	1
34		Soc.Grub Screw	1
35	1148	Key	1
36	2670	Input Shaft	1
37		'O' Ring	1
38	2683	Control Rod	1
39		'O' Ring	1
40		Compo Bush	1
41	3252	Gear	1
42		Hex.Hd.Screw	1
43		Fibre Washer	1
44	2723	Gasket	1
45		Soc.Cap Screw	10
46	2664	Gearbox Lid	1
47	2766	Oil Level Plug	1
48	2767	Fibre Washer	1
49		Ball Race	1
50		Circlip	1

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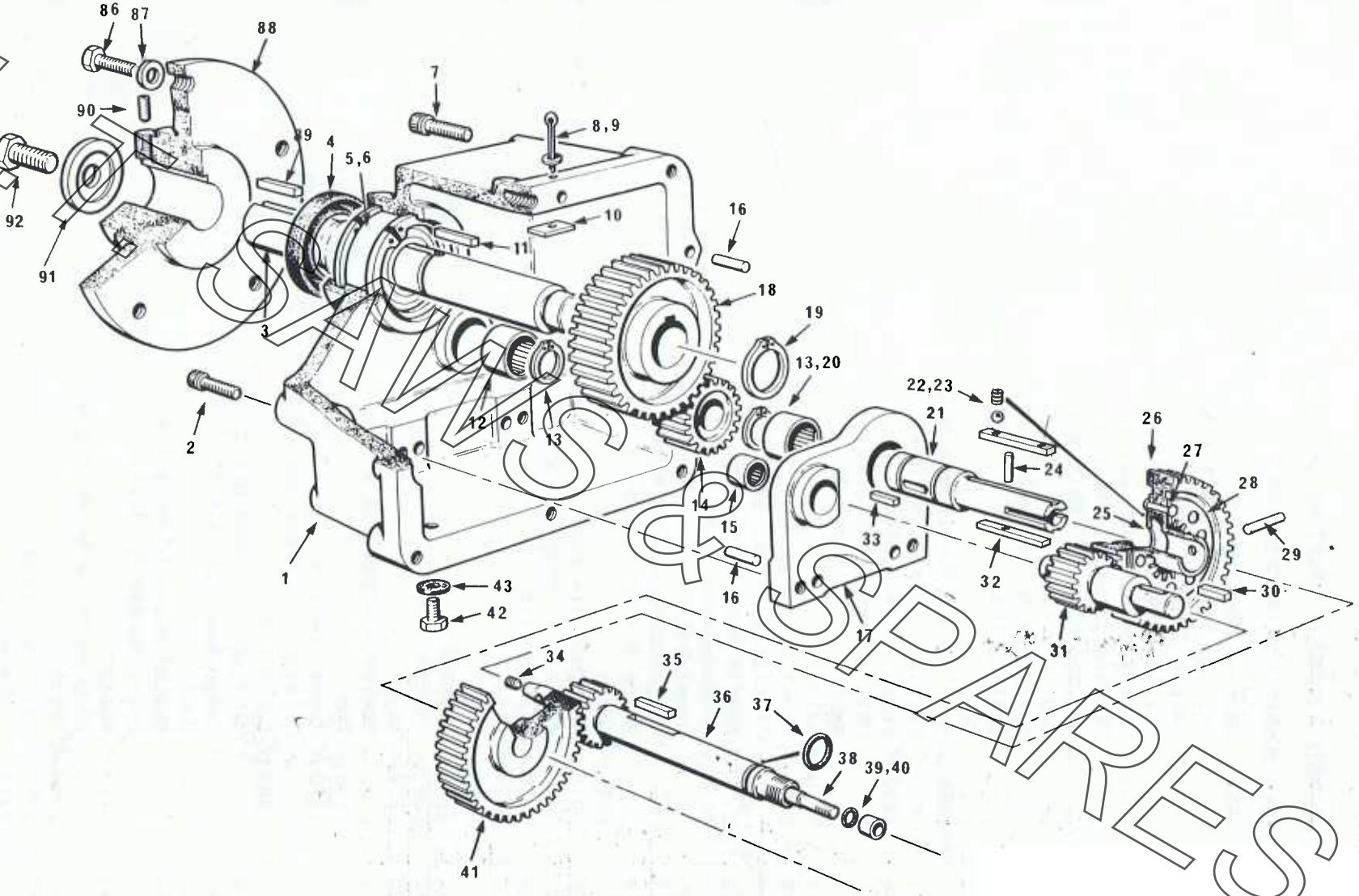
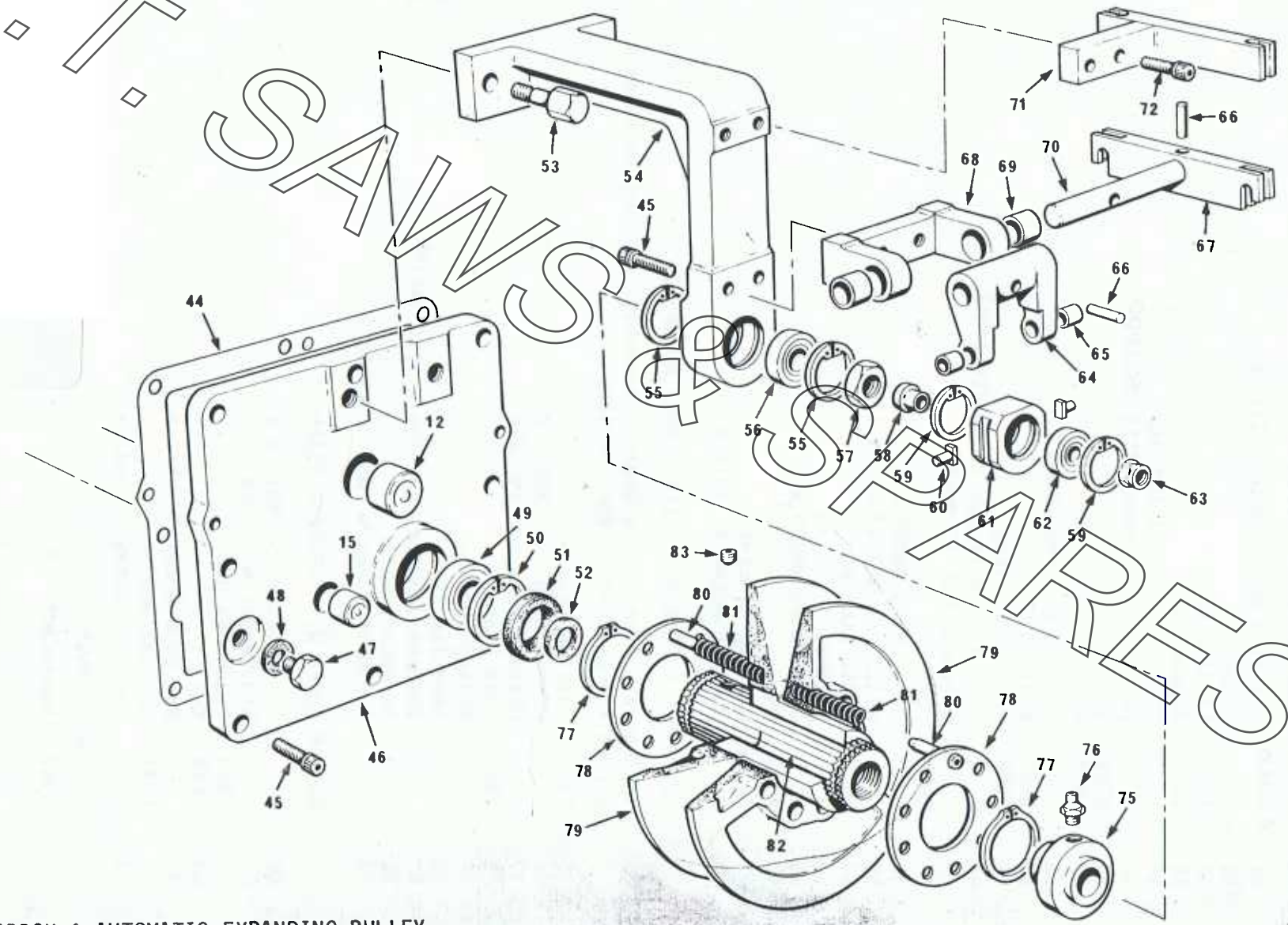


GEARBOX



GEARBOX & AUTOMATIC EXPANDING PULLEY

GEARBOX ASSEMBLY - PART No.SP331 - CONTINUED

ITEM	PART NUMBER	DESCRIPTION	No.OFF
51		Oil Seal	1
52	1209	Washer	1
53	2732	Fitting Bolt	2
54	2665	Support Arm	1
55		Circlip	2
56		Ball Race	1
57	2768	Special Nut	1
58	2617	Bearing Bush	1
59		Circlip	2
60	2597	Flatted Pin	2
61	2598	Bearing Housing	1
62		Ball Race	1
63		Simmonds Nut	1
64	2601	Fork	1
65		Compo Bush	2
66		Mills Pin	2
67	2947	Cable Link Arm	1
68	2733	Bracket	1
69		Compo Bush	2
70	2668	Shaft	1
71	SP366	Control Bracket	1
72		Soc.Cap Screw	2

AUTOMATIC EXPANDING PULLEY - PART No.SP342

Incorporate part of the Gearbox Assembly, but available as a separate sub-assembly for service.

75	2671	Sealing Cap	1
76		Grease Nipple	1
77		Circlip	2
78	2803	Core Plate	2
79	2761	Pulley Section	2
80	2804	Locating Pin	18
81		Compression Spring	18
82	2760	Serrated Shaft	1
83		Soc.Grub Screw	1

NOT INCLUDED WITH GEARBOX ASSEMBLY

86		Hex.Hd.Screw	5
87		Std.Washer	5
88	2943	Bandwheel Hub	1
89	2659	Key	1
90		Soc.Grub Screw	1
91	6541	Special Washer	1
92		Hex. Hd. Screw	1

NOT ILLUSTRATED :

2937 Bandwheel

INSTRUCTIONS FOR DISMANTLING AND RE-ASSEMBLING GEARBOX.

To remove the gearbox from the bandsawing machine :-
Drain oil by removing hexagon screw and washer (Items 42 & 43).
Remove bandsaw blade, slacken the locking screw in the hub (Items 90 & 88) and pull bandwheel complete with hub off the output drive shaft (Item 3).
From the rear of the machine, remove two screws (Item 72) and control bracket (Item 71), then disengage the control cables.
Support the gearbox and carefully remove the four socket cap screws (Item 7) which secure the gearbox in position. Note the existence of shim washers (where fitted) between the gearbox and the mounting pads in the machine body.
Remove the Automatic Expanding Pulley Assembly, see page 6.
Punch out two dowels (Item 16) remove 8 screws (Item 45) and separate the gearbox housing (Item 1) and gearbox lid (Item 46).
Lift out the layshaft and gear (Items 31 & 41). Pull the control shaft (Item 38) away from the gearbox housing which will also remove the gear and clutch assembly (Items 25,26,27,28 & 29). Take care not to lose the spring and steel ball (Items 22 & 23) concealed within the liner.
Punch through two dowels (Item 16) and remove two screws (Item 2) securing the bridge casting (Item 17). Lift out bridge complete with intermediate shaft (Item 21) and final drive pinion (Item 14).
The method of removal of the final drive gear (Item 18) will vary according to whether or not the gear has extractor bolt holes. In either case, remove the circlip (Item 19) which locates the gear in position. If extractor bolts are provided, the gear may be drawn off the output shaft (Item 3) by inserting two bolts (⅜" UNC. or Whitworth). Should extractor holes not be provided, prise out the oil seal (Item 4), remove circlip (Item 6) and gently tap out the output drive shaft from the small end.
The lid section of the gearbox may readily be dismantled by pressing out the input shaft (Item 36) and removing the oil seal, circlip and bearing as required.
The shift gear (Item 26) is rivetted to the liner (Item 25) and clutch (Item 28) with 8 mild steel rivets (Item 27). It is recommended that these items be ordered as pre-assembled items should any replacement be necessary. Ensure that a replacement liner is a free sliding fit over the intermediate shaft (Item 21) and dimpled keys (Item 32). Insert spring and steel ball (Items 22 & 23) into liner before final assembly.
Further assembly is in reverse order to dismantling. Be sure to follow instructions relating to the assembly of the Automatic Expanding Pulley Assembly, see page 6.
Fill the gearbox with oil to the level of the filler hole, see maintenance instructions - Section on Installation/Maintenance.

SECTION 80

INSTRUCTIONS FOR DISMANTLING AND RE-ASSEMBLING AUTOMATIC EXPANDING PULLEY.

To dismantle the unit from the gearbox :-
Set the machine to run at 360 feet per minute (110 meters per minute) and switch off. While the motor is stationary, set the speed control dial to indicate 50 feet per minute (15 meters per minute). Both sets of expanding pulleys will now be fully open, thus allowing the variable speed drive belt to be slipped off the master expanding pulley.
Remove two screws (Item 72) and control bracket (Item 71), then disengage the control cables. Remove simmonds nut (Item 63), withdraw bearing housing (Item 61) and bearing bush (Item 58) from the end of the control rod (Item 38).
Slacken the locking screw (Item 83) securing the serrated shaft (Item 82). The screw is located behind the inner pulley section.
Remove nut (Item 57) and two fitting bolts (Item 53), pull the support arm (Item 54) away from the gearbox and remove the variable speed drive belt.
IMPORTANT : The input shaft (Item 36) is now unsupported at the end, therefore take care that it is not subjected to undue strain.
The Automatic Expanding Pulley Assembly may now be pulled off the input shaft.
The 'O' seal and sealing washer (Items 37 & 52) should be renewed before re-assembly.
The Automatic Expanding Pulley Assembly may be readily dismantled into its component parts (Items 75 to 83). It is essential that the two pulley sections (Item 79) and the serrated shaft (Item 82) be renewed as a set.

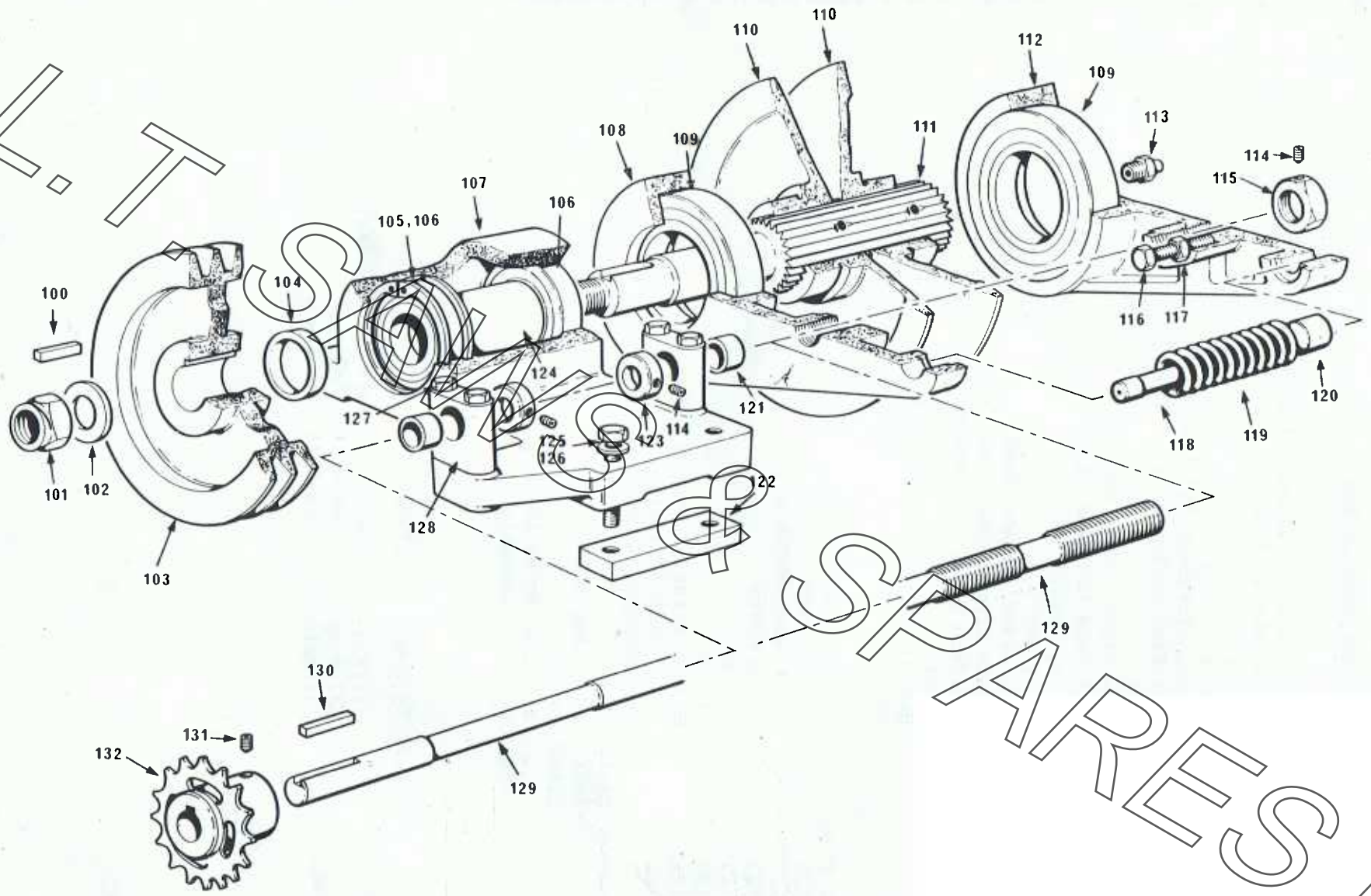
Fitting the Automatic Expanding Pulley Assembly to the gearbox :-
Slide the unit onto the input shaft making sure the key (Item 35) is in position. Do not tighten the locking screw (Item 83) at this stage.
Place the variable speed drive belt over the expanding pulley.
Re-assemble the support arm (Item 54) and secure in position with the fitting bolts (Item 53). Assemble and tighten nut (Item 57).
Push the serrated shaft (Item 82) towards the gearbox. The end of the serrated shaft must be held in firm contact with the sealing washer (Item 52) while the locking screw (Item 83) is tightened.
Work the variable speed drive belt into the expanding pulley so that the spring loaded pulley sections are forced apart.
With the automatic pulley wedged in the fully open position, pass the free end of the drive belt over the master expanding pulley. Turn pulleys by hand to remove slack in the drive belt.
Complete re-assembly in reverse order to dismantling. It is important that the automatic expanding pulley is lubricated before use according to the maintenance instructions - see Section on Installation/Maintenance.
Calibrate speed selector dial if necessary, also see Section on Installation/Maintenance.

MASTER EXPANDING PULLEY - PART No.SP344

ITEM	PART NUMBER	AND DESCRIPTION	No.OFF
100	2959	Key	1
101		Turret Nut Phillidas	1
102		Std.Washer	1
103	2966	Pulley	1
104	2961	Spacer	1
105		Circlip	2
106		Ball Race	2
107	2967	Base	1
108	2776	Side Plate - Left Hand	1
109		Ball Race	2
110	2778	Pulley Section	2
111	2964	Drive Shaft	1
112	2777	Side Plate - Right Hand	1
113		Grease Nipple -	1
114		Soc.Grub Screw -	5
115	2960	Special Lock Nut	1
116		Hex.Hd.Screw	1
117		Std.Nut	1
118	2770	Guide Pin	1
119	3108	Compression Spring	1
120	2772	Guide Sleeve	1
121		Compo Bush	2
122	2968	Clamp Plate	2
123	666	Collar	2
124	2962	Spacer	1
125		Hex.Hd.Screw	4
126		Std.Washer	4
127		Hex.Hd.Screw	4
128	2963	Block	2
129	2965	Adjusting Shaft	1
130	1149	Key	1
131		Soc.Grub Screw	1
132	SP341	Sprocket Assembly	1

VEE-BELTS - NOT ILLUSTRATED

	Variable Speed Drive Belt	1
	Pump Drive Vee-Belt	1
	Main Drive Vee-Belt	2



MASTER EXPANDING PULLEY

CONTROL PANEL - PART No.SP357

ITEM	PART NUMBER	DESCRIPTION	No.OFF
1	2885	Control Panel Body	1
2	2894	Indicator Plate (Imperial)	1
	3564	Indicator Plate (Metric)	1
3		PK Drive Screw	8
4	2890	Layshaft	1
5	2678	112 Tooth Gear	1
6		Compo Bush	1
7	2677	Indicator Drum	1
8	2757	Calibrated Strip (Imperial)	1
	3486	Calibrated Strip (Metric)	1
9	2674	Control Wheel	1
10		Circlip	1
11		Shoulder Screw	2
12		Rencol Handle	2
13		Soc.C'sk.Screw	1
14	3295	Locking Wedge	1
15	2889	Control Shaft	1
16		Soc.Cap Screw	2
17		Woodruff Key	1
18		Rencol Knob	1
19	885	Stud	1
20	2891	Speed Change Shaft	1
21		Washer	1
22		Philips Rd.Hd.Screw	4
23		Philips Rd.Hd.Screw	4
24		Hex.Lock Nut	4
25		Hex.Hd.Screw	2
26		Hex.Lock Nut	2
27	2886	Operating Arm for Speed Change	1
28		Mills Pin	2
29		Flexo Spring	1
30		Mills Pin	1
31	4189	Actuator Link Pin	1
32		Mills Pin	1
33	4188	Spring Actuator	1
34	5580	Pivot Pin	1
35		Mills Pin	1
36		Compo Bush	2
37	2893	Cable Connecting Plate	1
38		Hex.Hd.Screw	2
39	3225	Spacer	1
40	3226	Small Thrust Washer	1
41		Flexo Spring	1
42	3227	Large Thrust Washer	1
43	◇	Circlip	4
44		Hoffmann Sealed Ball Race	4
45	2675	21 Tooth Pinion	1
46		Mills Pin	
47		Soc.Grub Screw	
48	SP341	Sprocket Assembly	

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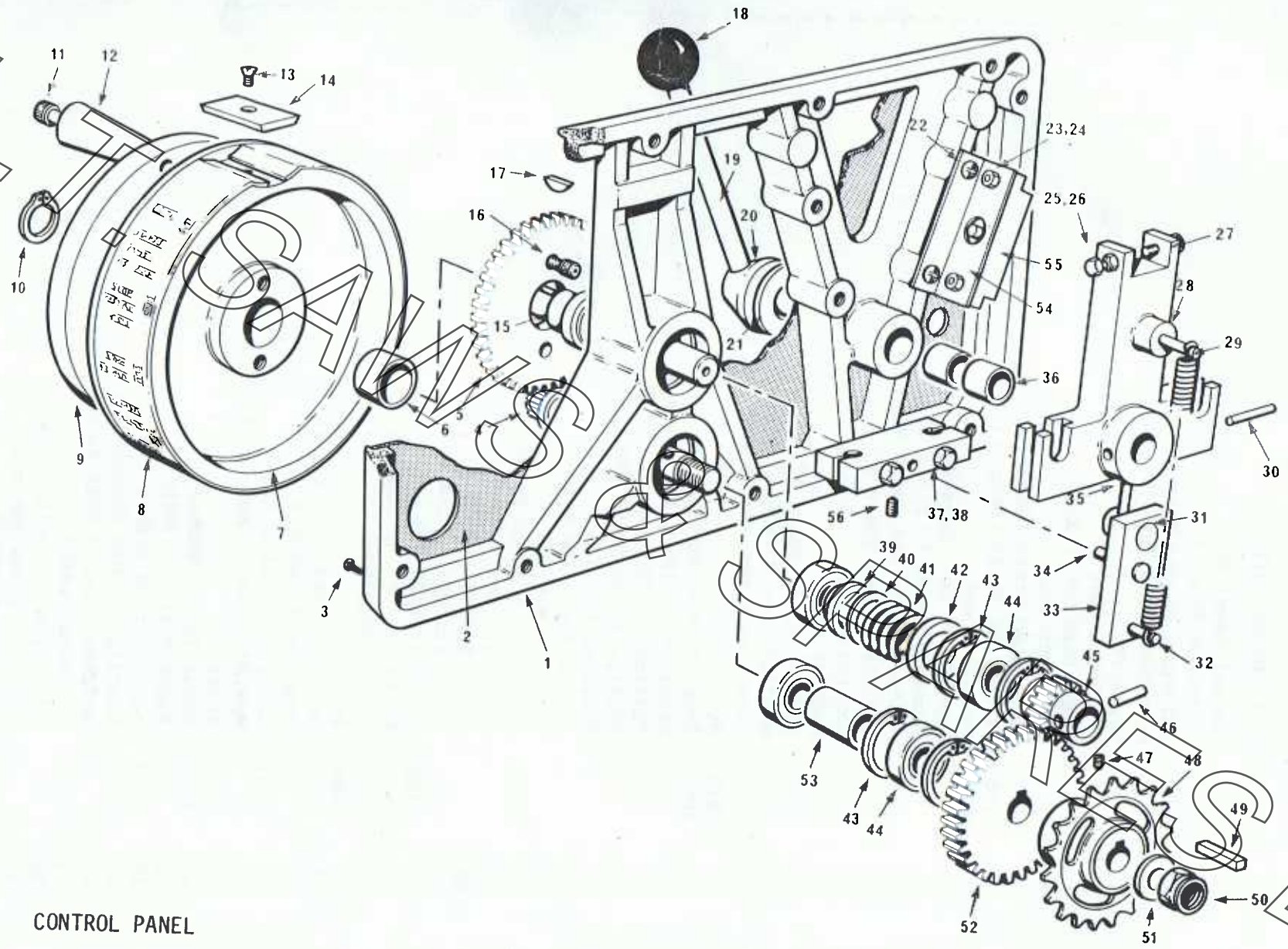


CONTROL PANEL

CONTROL PANEL - PART No.SP357 - CONTINUED

ITEM	PART NUMBER	AND DESCRIPTION	No.OFF
49	1149	Key	1
50		Simmonds Nut	1
51		Std.Washer	1
52	2887	63 Tooth Gear	1
53	2672	Spacer	1
54	2895	Limit Switch Bracket	2
55		Burgess Micro Switch	2
56		Soc. Set Screw	1

NOT ILLUSTRATED :

	Arcolectric Toggle Switch	2
	Arcolectric Red Signal Lamp	1
	Arcolectric Amber Signal Lamp	1
	Allen-Bradley	1
	Allen-Bradley	1
	Allen-Bradley	1
	Lamp M.B.C.	2

CHAIN TENSIONING ASSEMBLY - PART No.SP378

60	2866	Spindle Nut	1
61	3056	Spindle	1
62		Compo Bush	1
63	SP379	Sprocket Assembly	1
64	2447	Special Washer	1
65		Hex.Hd.Screw	1
66		Elite Chain 216 Models	1
		Elite Chain 316 Models	1

CONTROL CABLE DETAILS

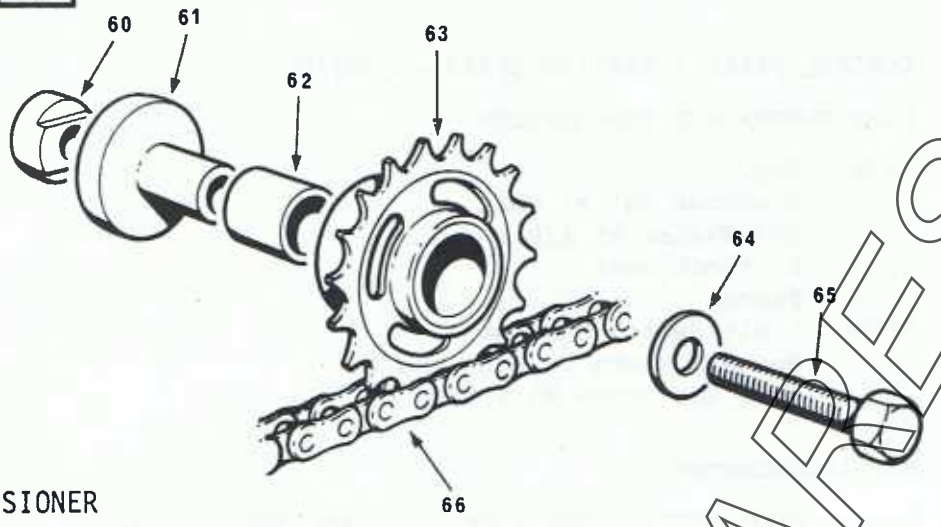
70	SP405	Control Cable Assembly - 216 Models	2
	SP406	Control Cable Assembly - 316 Models	2

LAMP HOLDER - ASSEMBLY No.SM1003

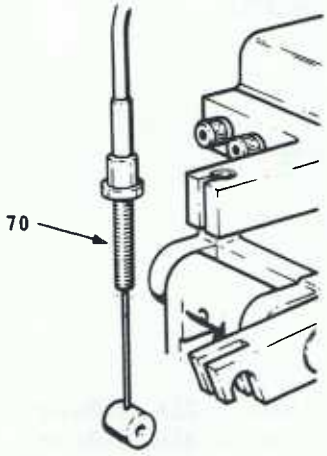
80	5463	Lamp Shade	1
81	501297	Lamp No.	1
82	3601	Lens Mounting	1
83	3605	Lens	1
84		Lamp Holder	1
85		Hex. Hd. Screw	1
86		Std. Washer	1

To remove lamp, press inwards, twist anti-clockwise and pull out.

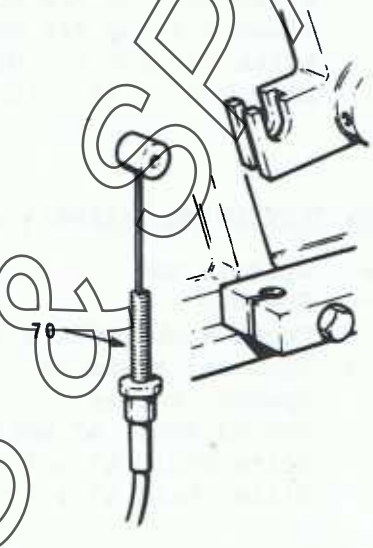
SECTION 83



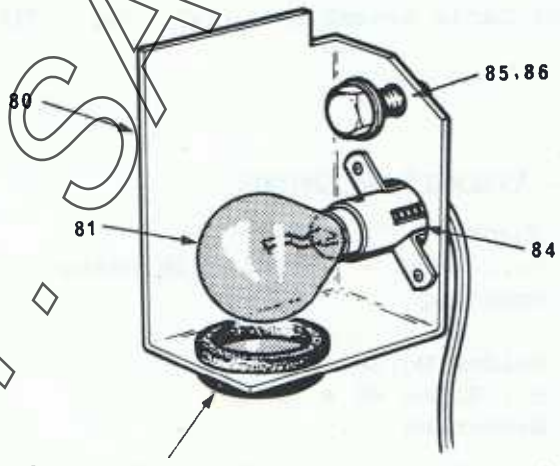
CHAIN TENSIONER



CABLE LINKAGE
ON GEARBOX



CABLE LINKAGE AT REAR
OF CONTROL PANEL



WORKLIGHT

TOP BRACKET ASSEMBLY - PART No.SP362

ITEM	PART NUMBER	AND DESCRIPTION	No.OFF
1	2882	Top Bracket Body	1
2		Soc.Cap Screw	1
3	2226	Spring Locating Drum	1
4		Tensator Spring	1
5		Tensator Spring	1
6		Circlip	2
7		Hoffmann Bearing	2
8	2227	Spacer	1
9		Mills Pin	1
10	2923	Guide Post	1
11		Soc.Cap Screw	5
12	2928	Rack	1
13	2884	Retaining Bracket	1
14	2958	Collar	1
15		Compo Bush	2
16	2934	Pinion	1
17		Mills Pin	2
18		Evans Handknob	2
19		Soc.Grub Screw	4
20	2924	Locking Pad	1
21		Std.Washer	1
22	2935	Locking Screw	1
23		Flexo Spring	1
24		Soc.Cap Screw	6
25	2930	Guide Plate	2
26		Soc.Cap Screw	1
27		Std.Washer	1
28	2926	Tension Plate	1
29		Disc Spring	72
30	2929	Retaining Plate	1
31		Hex.Hd.Screw	2
32		Disc Spring	4
33		Hex.Lock Nut	1
34		Mills Pin	1
35	2925	Handle	1
36		Shoulder Screw	2
37		Rencol Handle	2
38		Std.Washer	2
39		Compo Bush	1
40	4234	Spring Pilot Pin	2
41		Torrington Thrust Race	2
42		Torrington Needle Thrust Bearing	1
43	2927	Tension Screw	1
44		Soc.Grub Screw	2
45		Std.Nut	2
46	2931	Nut	1
47	2883	Tension Bracket	1
48		Soc.Cap Screw	4
49	2881	Pivot Pin	1
50	2880	Tilt Bracket	1

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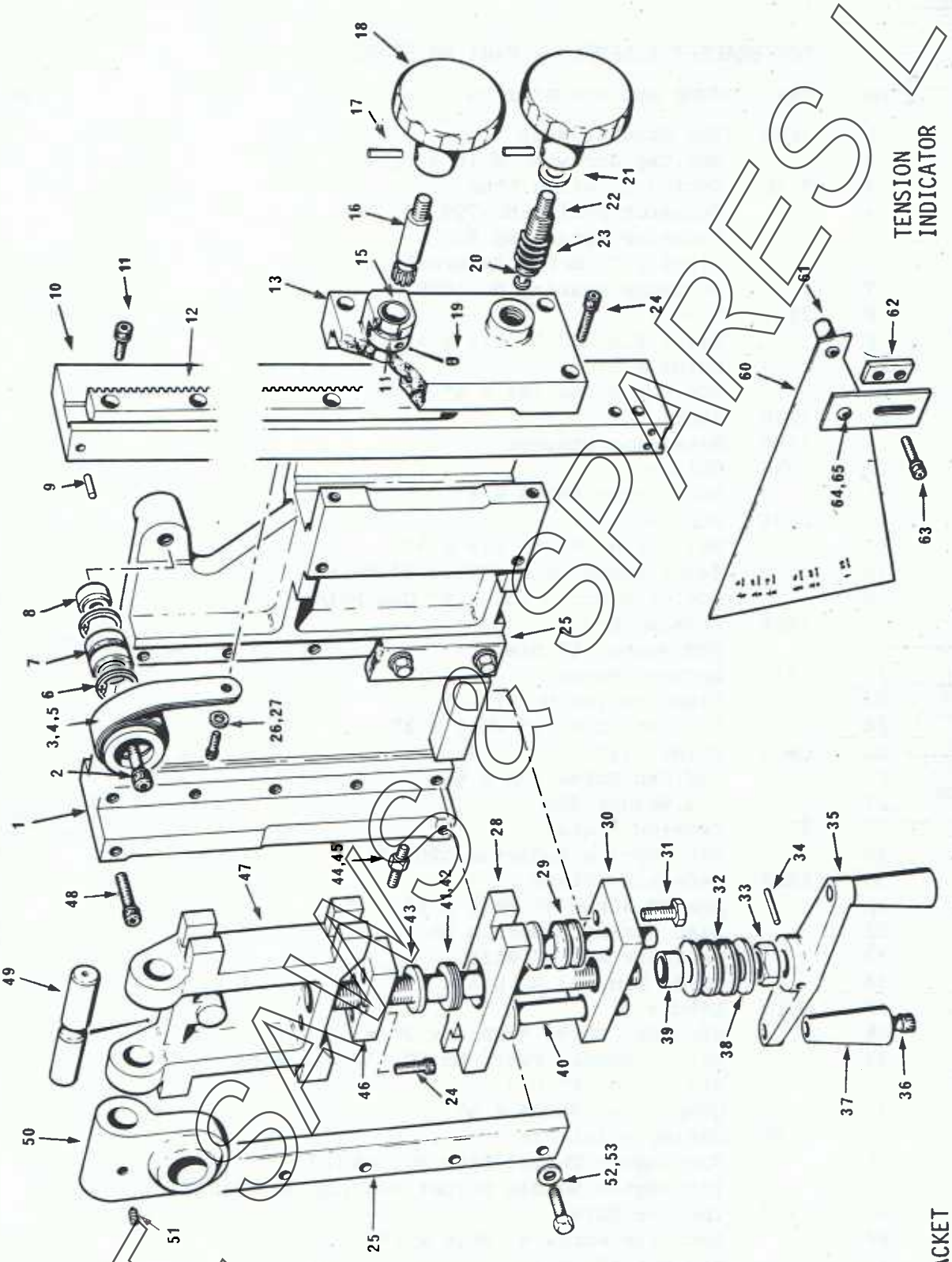


TOP BRACKET ASSEMBLY - PART No.SP362 - CONTINUED

ITEM	PART NUMBER AND DESCRIPTION	No.OFF
51	Soc.Grub Screw	1
52	Hex.Hd.Screw	10
53	Std.Washer	10

TENSION INDICATOR ASSEMBLY - PART No.SP365/1

60	4233/1	Tension Indicator Plate (¼" - 1")	1
61	2941	Register Pin	1
62	2940	Clamping Bar	1
63		Soc.Cap Screw	2
64	2939	Pivot Pin	1
65	2942	Pivot Plate	1

TRACKING HUB ASSEMBLY - PART No.SM364

70	2466	Adhesive Metal Nameplate	1
71	2873	Knurled Hand Nut	1
72		Soc.Set Screw	2
73	2876	Shaft	1
74	2874	Knurled Lock Nut	1
75	3342	Washer	1
76	2875	Bearing Shaft	1
77		Single Row Radial Ball Bearing	2
78	2878	Spacer	1
79		Std.Circlip	2
80	2877	Bandwheel Location	1
81		Std. Washer	5
82		Hex.Hd.Screw	5
83	7911	Bandwheel 16" Dia	3

All Bandwheels are Interchangeable.

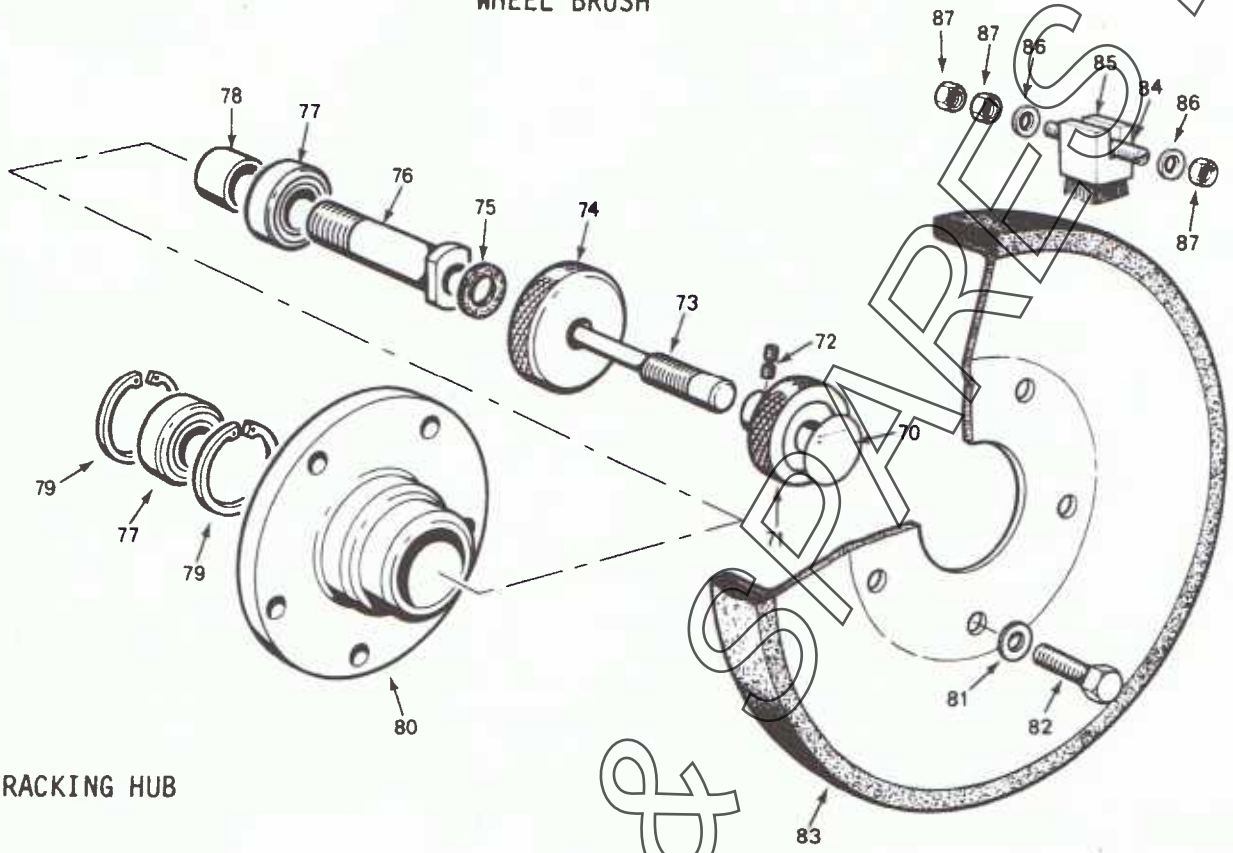
WHEEL BRUSH DETAILS

84	2579	Stud	1
85	2270	Wheel Brush	1
86		Std.Washer	2
87		Std.Nut	3

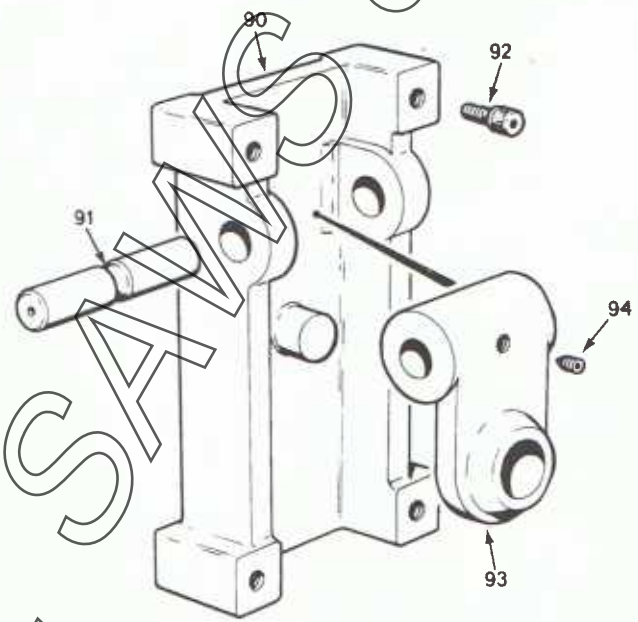
JOCKEY WHEEL BRACKET - PART No.SP363

90	2879	Bracket	1
91	2881	Pin	1
92		Soc.Cap Screw	4
93	2880	Tilt Bracket	1
94		Soc.Grub Screw	1

WHEEL BRUSH



TRACKING HUB



JOCKEY WHEEL
BRACKET

SLIDING TABLE - ASSEMBLY No.SM1101

ITEM	PART NUMBER AND DESCRIPTION		No.OFF
1	5694	Sliding Table	1
2		Std. Stud	2
3	2828	Swing Latch	1
4		Std. Washer	2
5		Handknob	2
6	2922	Table Insert	1
7		Slotted C'sk. Hd. Screw	1

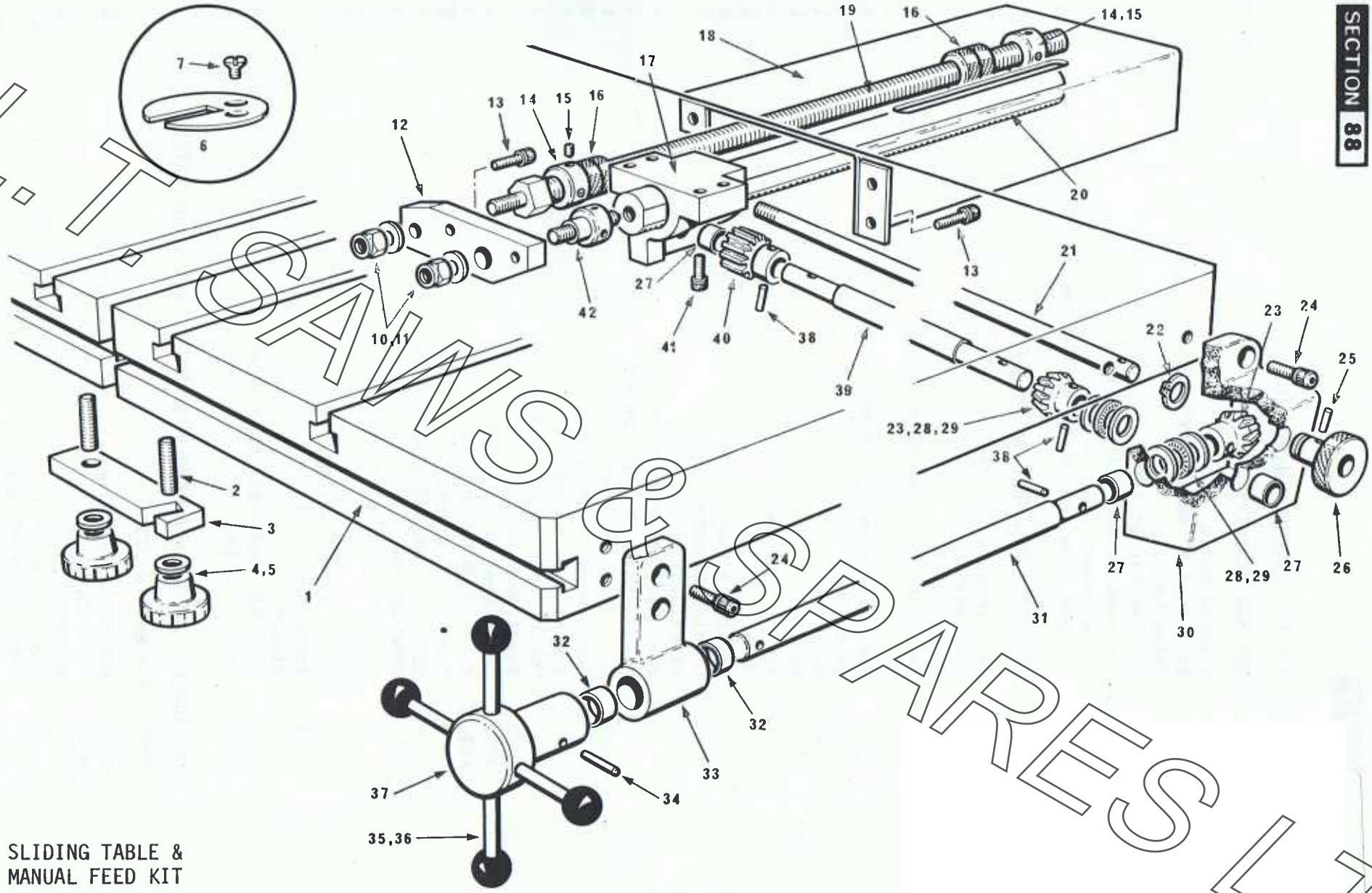
MANUAL FEED KIT - ASSEMBLY No.SM1124

10		Self Locking Nut	2
11		Std. Washer	2
12	4419	Anchor Plate	1
13		Soc. Hd. Cap Screw	5
14	3210	Stop Collar	2
15		Soc. Set Screw	4
16	663	Feed Stop Nut	4
17	2830	Rack Housing	1
18	SP649	Rack Cover	1
19	SM1121	Feed Stop Screw	1
20	5750	Rack	1
21	2915	Locking Screw	1
22		Circlip	1
23	2715	Mitre Gear	2
24		Soc. Hd. Cap Screw	4
25		Mills Pin	1
26	2819	Locking Screw Knob	1
27		Compo Bush	3
28		Thrust Race	4
29		Thrust Bearing	2
30	2829	Bevel Gear Housing	1
31	5751	Outer Feed Shaft	1
32	302305 -	Compo Bush	2
33	2827	Feed Shaft Bracket	1
34		Mills Pin	1
35	2917	Feed Handle	4
36		Ball Knob	4
37	2919	Hub	1
38		Mills Pin	3
39	2914	Inner Feed Shaft	1
40	2836	Pinion	1
41		Soc. Hd. Cap Screw	4
42	2956	Rack Coupling	1

SUB-TABLE PLATFORM - ASSEMBLY No.SP375 (NOT ILLUSTRATED)

NOTE : 316 Models ONLY.

SP375	Sub-Table Platform	1
3006	Sub-Table	1
3216	Mounting Stud	4
	Hex. Nut	12
	Std. Washer	8



SLIDING TABLE &
MANUAL FEED KIT

CRADLE - ASSEMBLY No.SM1102

ITEM	PART NUMBER	AND DESCRIPTION	No.OFF
50	2907	Roller Spindle	4
51		Needle Thrust Bearing	8
52		Thrust Race	12
53		Needle Bearing	4
54	2908	Roller	4
55	2909	Sealing Ring	4
56		Pan Hd. Recessed Screw	4
57	2912	Tilt Scale	1
58		Hex. Hd. Bolt	1
59	2903	Seating Washer	1
60	2901	Clamp	1
61	2897	Trunnion	1
62		Soc. Hd. Cap Screw	4
63	3142	Felt Wiper	2
64	3141	Side Plate	4
65		Std. Washer	6
66		Pan Hd. Recessed Screw	4
67	5742	Roller Shroud L.H.	1
	5742/1	Roller Shroud R.H.	1
68		Soc. Hd. Cap Screw	2
69	5741	Clamp Bar	2
70	2898	Compound Cradle	1
71	2899	Bottom Cradle	1
72		Spring Dowel	2
73	2904	Collar	1
74		Compression Spring	1
75	2906	Special Washer	1
76	2905	Special Nut	1
77		Soc. Hd. Cap Screw	4
78	2913	Compound Tilt Scale	1
79		Drive Screw	2
80	2812	Pointer	2
81		Soc. Hd. Cap Screw	6
82		Hex. Hd. Screw	4
83		Hex. Nut	4
84	5728	Roller Bracket	2
85	3614	Keeper Plate	2
86		Hex. Hd. Screw	1
87		Hex. Nut	1
88	2910	Stop Pin	1
89	2911	Tommy Bar	1

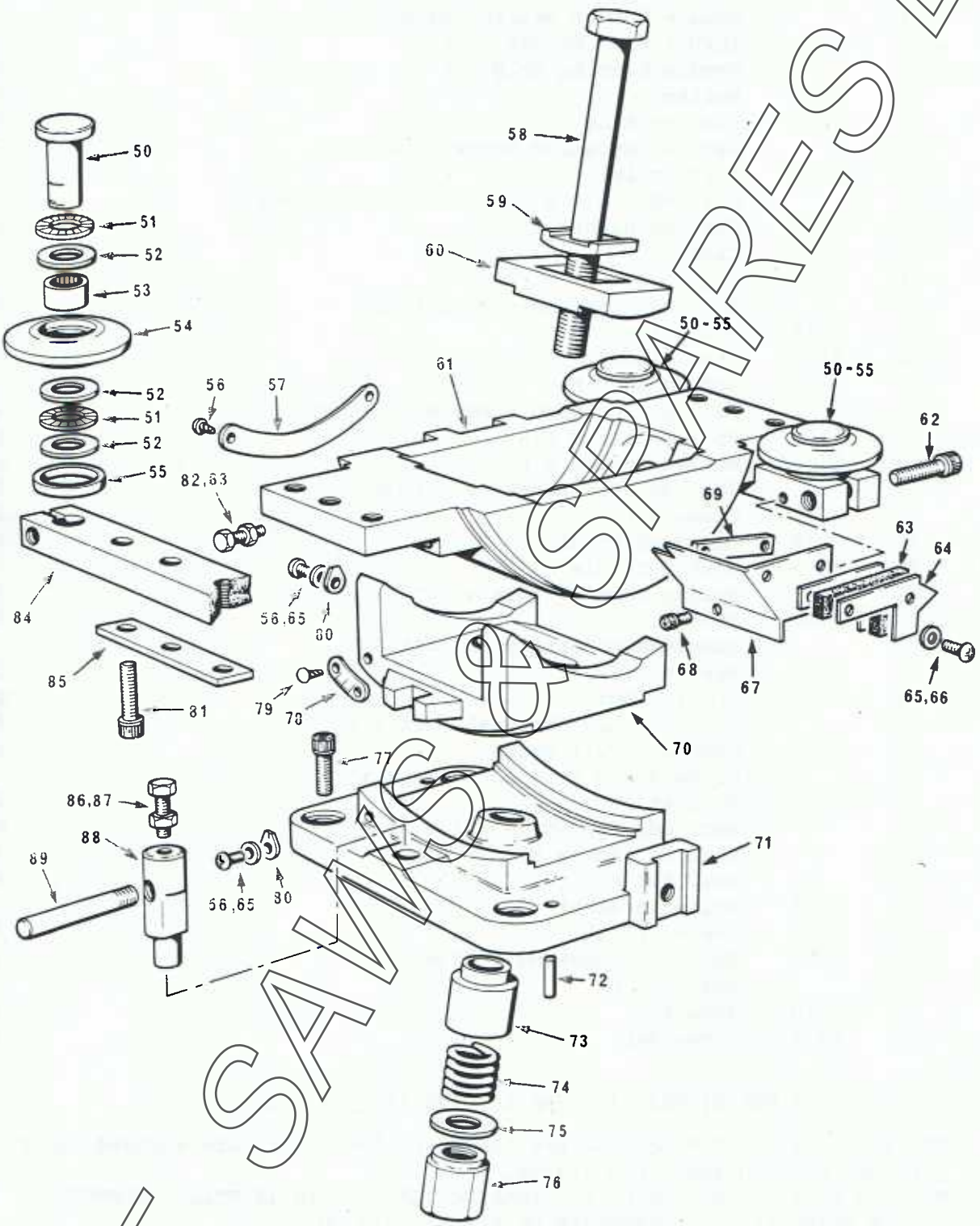
INSTRUCTIONS FOR DISMANTLING THE SLIDING TABLE & CRADLE.

The table is mounted on four pre-loaded rollers which are engaged under pressure between the table tracks.
BE SURE THAT THE METHOD OF PRE-LOADING THESE UNITS IS FULLY UNDERSTOOD BEFORE ATTEMPTING TO DISMANTLE OR ADJUST THIS UNIT.

1. Through the opening in the machine, remove special nut, washer, collar and compression spring (Items 73,74,75 & 76). Support the table whilst this operation is carried out.
2. Lift the table vertically away from the cradle mounting and place top face downwards on a bench.

(CONTINUED ON PAGE 5)

SECTION 88



CRADLE ASSEMBLY

INSTRUCTIONS FOR DISMANTLING THE SLIDING TABLE & CRADLE - CONTINUED.

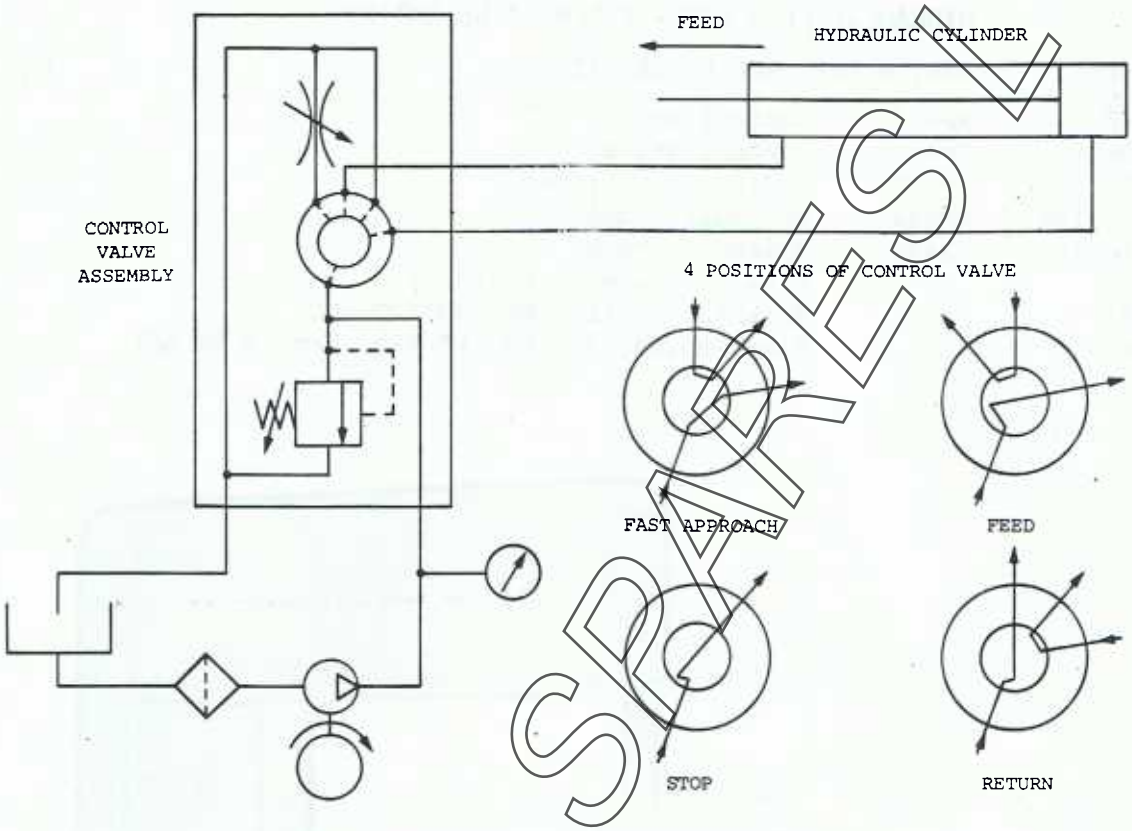
3. Remove two screws securing anchor plate (Items 12 & 13 of SM1124) to allow rack assembly to be disengaged, (manual feed machines.)
4. Mark both roller brackets (Item 84) to establish their original positions.
5. Screw inwards two jacking screws (Item 82) to one roller bracket only, (Do not alter the jacking screws to the second roller bracket or the pre-set alignment of the table will be lost) and remove three retaining screws (Item 81). The roller bracket can now be removed and the cradle assembly lifted away from the table.
6. Without disturbing the setting of the jacking screws, remove the second roller bracket.
7. Remove two shrouds with wiper assemblies (Items 63,64,67 & 69).
8. Slacken screws (Item 62) and press out roller spindle (Item 50) complete with roller and bearings.

INSTRUCTIONS FOR RE-ASSEMBLING THE SLIDING TABLE & CRADLE.

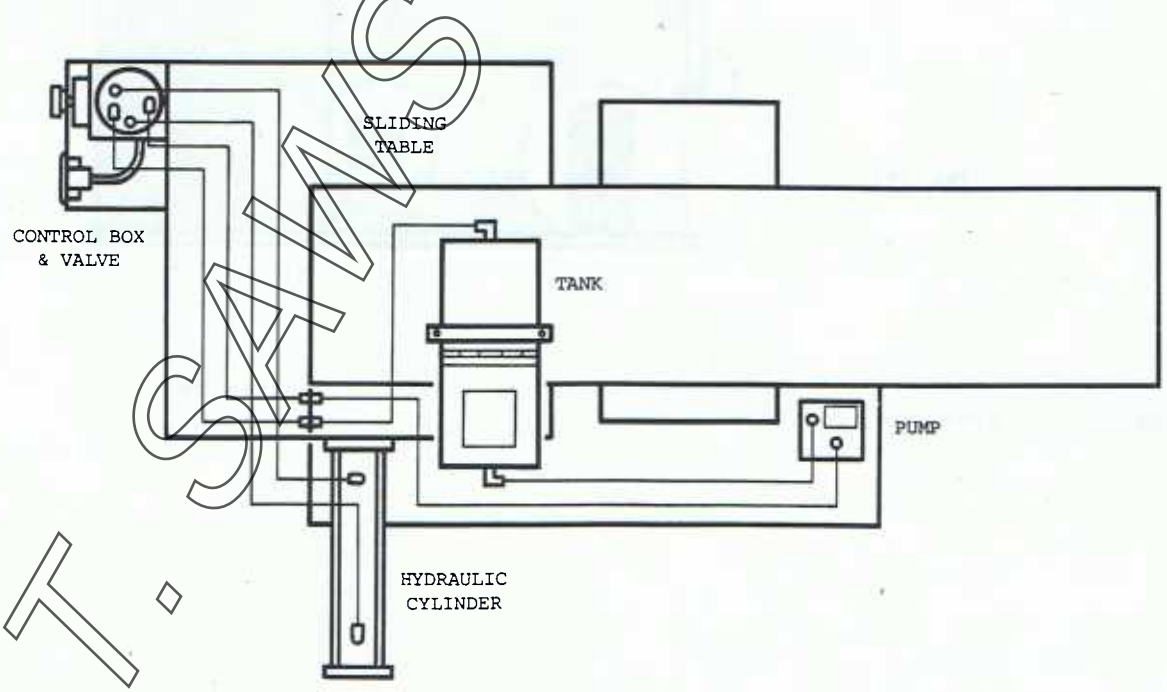
1. Assemble needle bearings, thrust washers and roller (Items 51,52,53,54 & 55) on roller spindle (Item 50) with light coating of medium grease.
NOTE : If the needle bearing (Item 53) have been replaced, check that they do not protrude beyond either face of the roller.
2. Insert the roller spindle complete with roller etc. into the roller bracket and press home with a force of 70 lb. (32 kg.). This pressure must be maintained whilst the clamping screw (Item 62) is securely locked. Assemble all four rollers in this fashion.
3. Assemble the appropriate roller bracket to the side of the trunnion which has the jacking screws in the original position and secure the bracket in place. Make sure that the side of the roller bracket is in contact with the head of the jacking screws.
4. Assemble the trunnion to the table so that the rollers engage in one side of the table track.
5. Place the second roller bracket in position and tighten the fixing screws with a light finger pressure only. Apply a force of 90 lb. (41 kg.) between the roller bracket and the trunnion to pre-load the rollers into the table tracks. Securely tighten the fixing screws whilst this force is maintained. Adjust the other two jacking screws so that their heads make firm contact with the side of the second roller bracket.
6. Assemble the roller shrouds making sure that the wipers make good contact with the table tracks and adjacent machined faces. New wipers should be charged with oil before fitting.
7. Complete assembly in reverse order, ensuring that there is good alignment of working parts in order to avoid undue stiffness to the table movement. New wipers will impart some additional stiffness which will ease as soon as the wipers have embedded down. On no account must the pre-loading be eased off in order to remove this preliminary stiffness.

TABLE ALIGNMENT.

The alignment of the table relative to the blade may be adjusted by careful setting of the position of the roller brackets. The table should be removed from the machine for this purpose and the instructions for pre-loading the rollers applied.



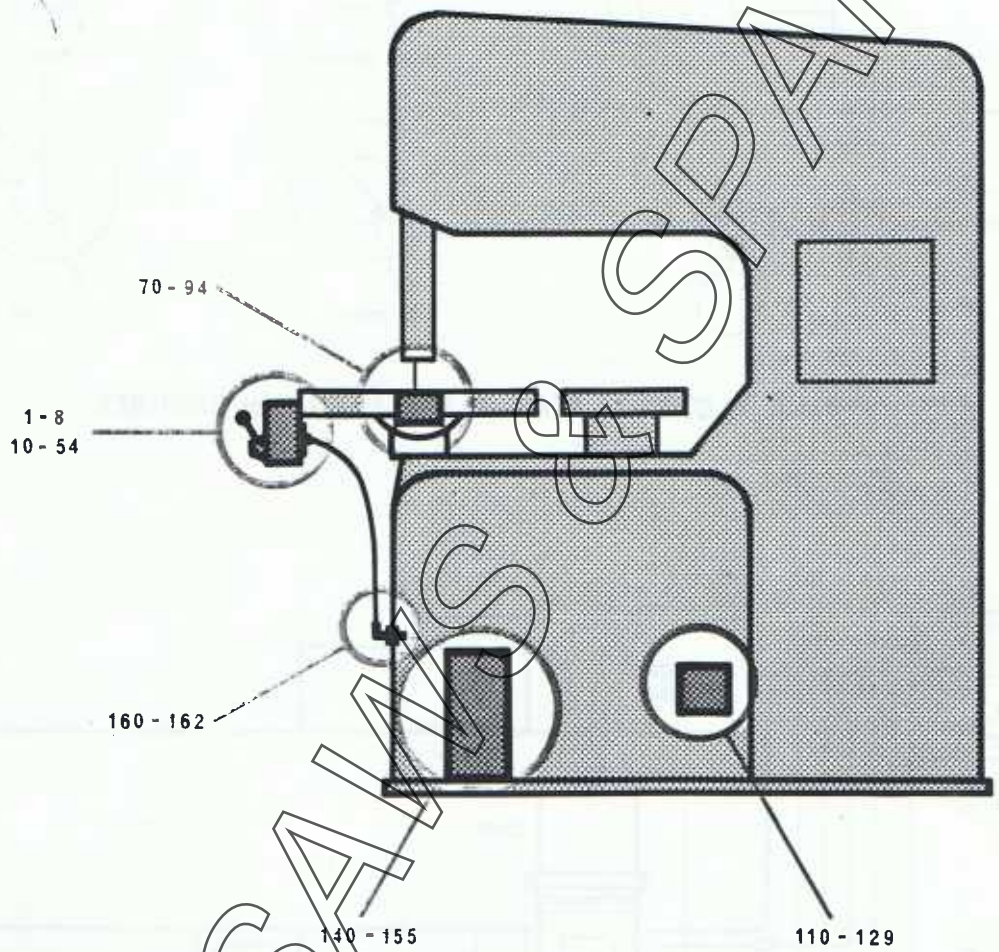
HYDRAULIC CIRCUIT DIAGRAM FOR 216H/316H MACHINES.



HYDRAULIC PIPE LAYOUT FOR 216H/316H MACHINES.

HYDRAULIC FEED KIT - ASSEMBLY No.SM1123

ITEM	PART NUMBER	AND DESCRIPTION	No.OFF
1-8	SP473	Control Box	1
10-54	SP463	Control Valve	1
70-94	SM1103	Hydraulic Cylinder	1
110-129	SP532	Hydraulic Pump	1
140-155	SP490	Hydraulic Tank	1
160		Flexible Tube	2
161		Bulkhead Fitting	2
162		Elbow	2



HYDRAULIC FEED KIT

CONTROL BOX - ASSEMBLY No.SP473

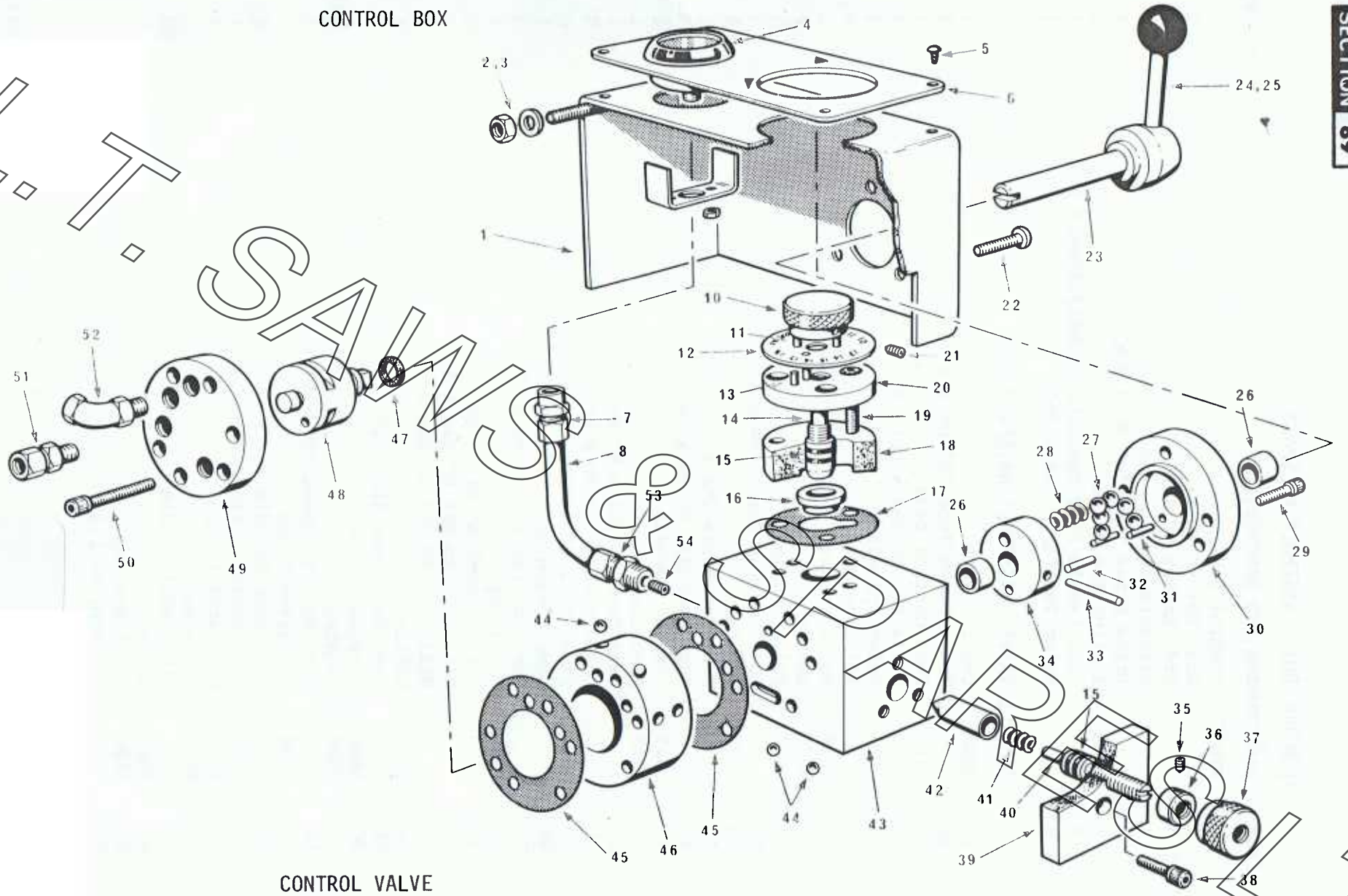
ITEM	PART NUMBER	AND DESCRIPTION	No.OFF
1	SP472	Control Box	1
2		Hex. Nut	2
3		Std. Washer	2
4		Pressure Gage	1
5		Drive Screw	4
6	3548	Instruction Plate	1
7		Par. Female Stud Coupling	1
8		Nylon Tube	1

CONTROL VALVE - ASSEMBLY No.SP463

10	3203	Control Knob	1
11		Drive Screw	2
12	3195	Feed Control Dial	1
13		Mills Pin	2
14	3533	Valve Spindle	1
15		'O' Ring	4
16	3534	Valve Insert	1
17	3536	Gasket	1
18	3527	Valve Housing	1
19		Soc. Hd. Cap Screw	3
20	3528	Top Cap	1
21		Soc. Set Screw	2
22		Soc. Dome Hd. Screw	3
23	3529	Control Spindle	1
24	2917	Feed Handle	1
25		Ball Knob	1
26		Compo Bush	2
27		Steel Ball	6
28		Compression Spring	1
29		Soc. Hd. Cap Screw	2
30	3523	Front Cap	1
31		Spring Dowel	2
32		Mills Pin	1
33		Mills Pin	1
34	3530	Collar	1
35		Soc. Set Screw	1
36	3606	Locking Collar	1
37	3607	Thumbnut	1
38		Soc. Hd. Cap Screw	3
39	3704	Regulator Block	1
40	3532	Regulator Spindle	1
41		Compression Spring	1
42	3535	Regulator Piston	1
43	3522	Valve Body	1
44		Steel Ball	10
45	3867	Gasket	2
46	3524	Spool Housing	1
47		'O' Ring	1
48	3526	Spool	1
49	3525	Rear Cap	1

(CONTINUED)

CONTROL BOX



CONTROL VALVE

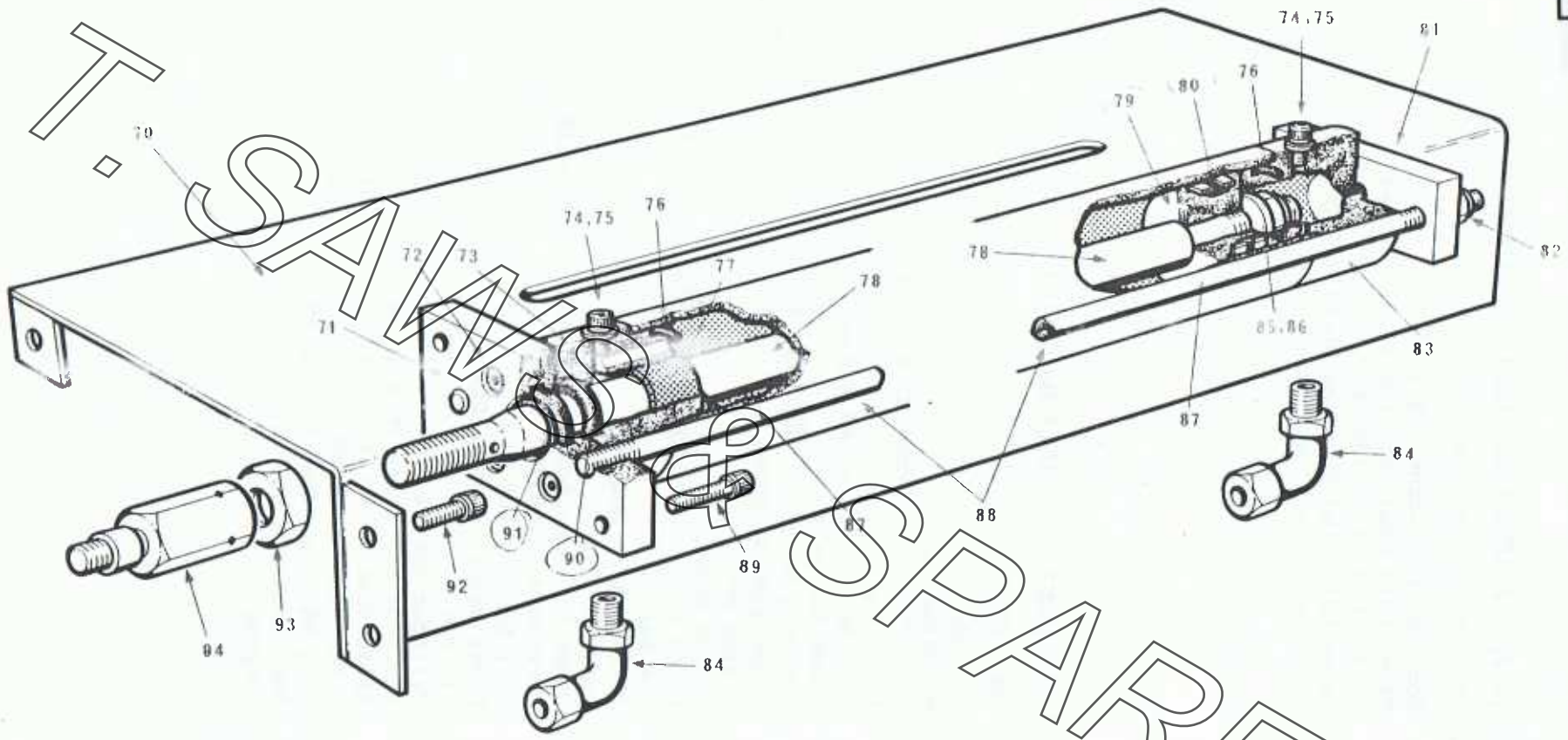
CONTROL VALVE - ASSEMBLY No.SP463 - CONTINUED

ITEM	PART NUMBER AND DESCRIPTION	No.OFF
50	Soc. Hd. Cap Screw	6
51	Taper Male Stud Coupling	2
52	Stud Elbow	2
53	Taper Male Stud Coupling	1
54	Soc. Set Screw	1

HYDRAULIC CYLINDER - ASSEMBLY No.SM1103

12" (305 mm) STROKE.

70	SP650	Cylinder Cover	1
71	5745	Mounting Plate	1
72		Soc. C'sk. Hd. Screw	4
73	5747	Front End Cap	1
74		Soc. Hd. Cap Screw	2
75		Fiber Washer	2
76		'O' Ring	2
77		Compo Bush	1
78	5737	Piston Rod	1
79	5738	Piston Head	1
80		Delta Seal	1
81	4401	Tie Bar	1
82		Self Locking Nut	2
83	5746	Rear End Cap	1
84		Taper Elbow	
		Ferrule	2
85		Self Locking Nut	1
86		Fiber Washer	1
87	5740	Tie Rod	2
88	5743	Cylinder Barrel	1
89		Soc. Hd. Cap Screw	4
90		Fluid Seal	1
91		Wiper Ring	1
92		Soc. Hd. Cap Screw	3
93		Hex. Lock Nut	1
94	5739	Adaptor	1



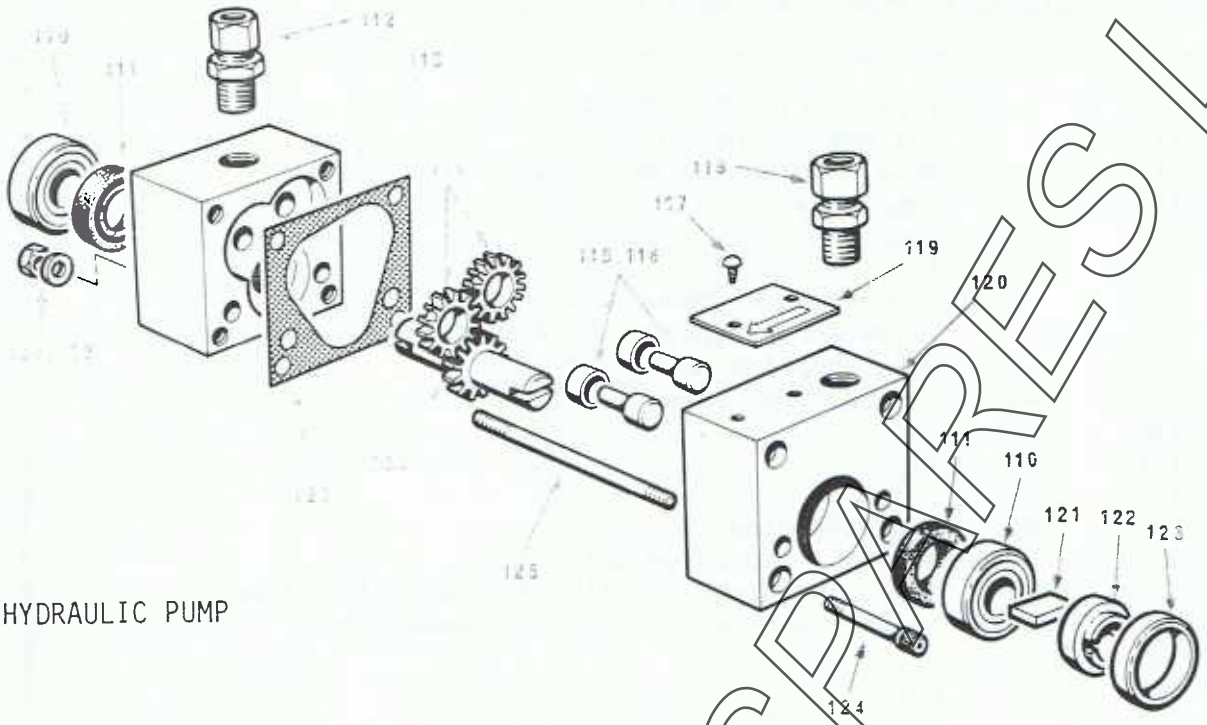
HYDRAULIC CYLINDER

HYDRAULIC PUMP - ASSEMBLY No.SP532

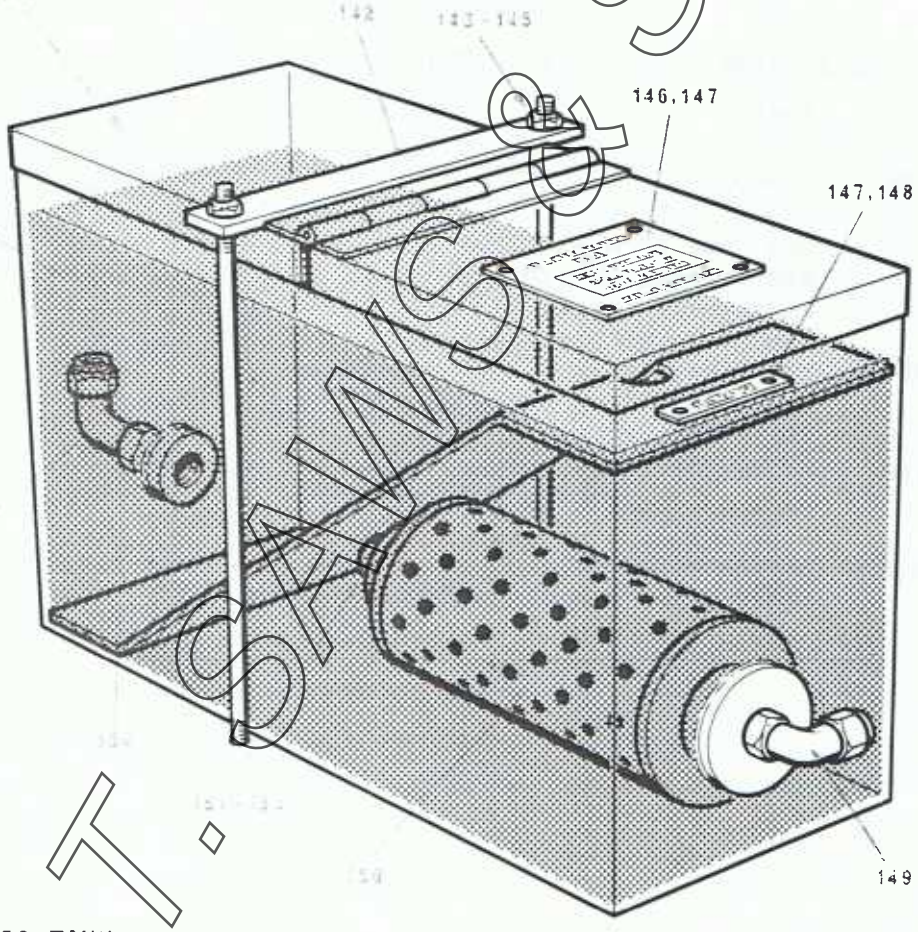
ITEM	PART NUMBER AND DESCRIPTION		No.OFF
110		Ball Bearing	2
111		Oil Seal	2
112		Male Coupling	1
113	3645	Pump Body	1
114	3648	Gear	2
115	994	Pin	2
116		Compo Bush	2
117		Drive Screw	2
118		Male Coupling	1
119	3649	Instruction Plate	1
120	3646	Cap	1
121	3608	Key	1
122	3588	Coupling	1
123	3589	Register Ring	1
124		Soc. Hd. Cap Screw	4
125	3609	Stud - Machines NOT fitted with Coolant Pump	2
	3639	Stud - Machines fitted with Coolant Pump	2
126	3647	Drive Shaft	1
127	3584	Gasket	1
128		Hex. Nut	2
129		Std. Washer	2

HYDRAULIC TANK - ASSEMBLY No.SP490

140	SP488	Tank	1
141	SP489	Tank Lid	1
142	3602	Clamp	1
143	3604	Stud	2
144		Hex. Nut	2
145		Std. Washer	2
146	3597	Instruction Plate	1
147		Pop Rivet	6
148	3598	Oil Level Plate	1
149		Taper Male Stud Elbow	1
150	3c2569	Filter	1
151	3187	Filter Retaining Washer	1
152		Hex. Hd. Bolt	1
153		Std. Washer	1
154	3596	Baffle Plate	1
155		Taper Male Stud Elbow	1



HYDRAULIC PUMP



HYDRAULIC TANK

AIR COMPRESSOR - PART No.SP486

ITEM	PART NUMBER	DESCRIPTION	No.OFF
1	5354	Pulley	1
2		Soc. Set Screw	1
3		Ball Race	2
4	3575	End Cap	1
5	1148	Key	1
6	3579	Vane	2
7	3599	Filter Mounting	1
8		Hex. Hd. Screw	1
9	3611	Washer	1
10		Filter	1
11	3612	Washer	1
12		Tube Connector	1
13		Circlip	1
14	3577	Cylinder Mounting	1
15	3576	Cylinder	1
16	3578	Rotor	1
17		Soc.Cap Screw	3

CHIPBLOWER ASSEMBLY - PART No.PK174

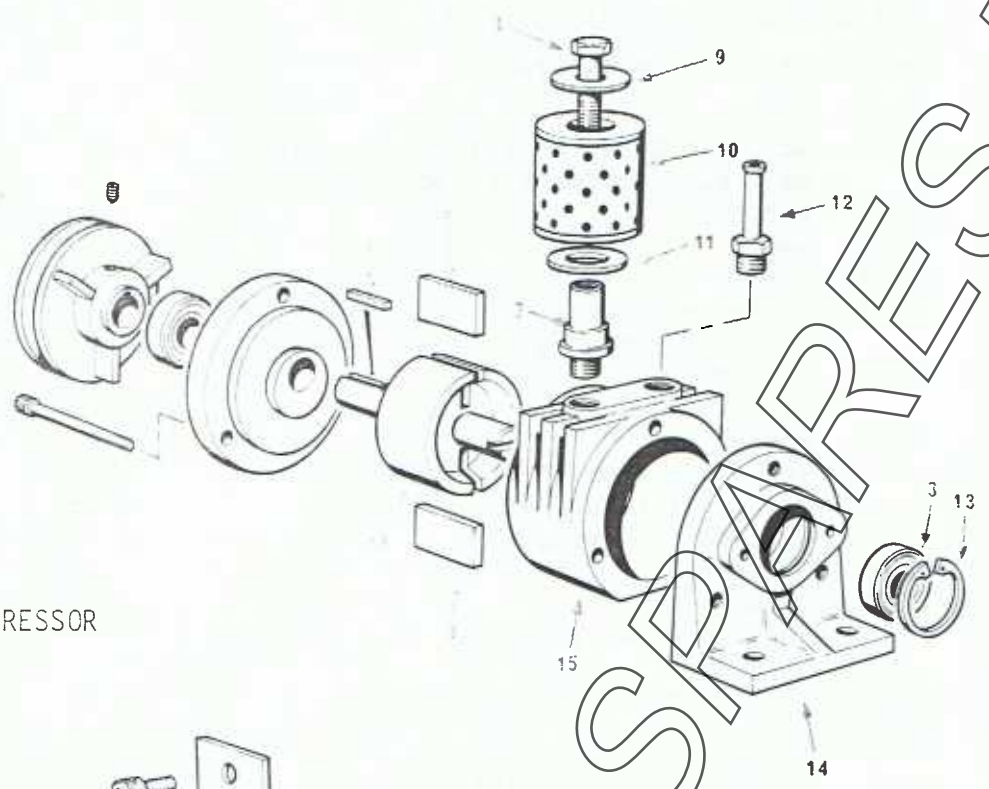
20	4931	Mounting Plate	1
21		Nylon Sleeve	1
22		Clear PVC Tube (216 Models)	1
		Clear PVC Tube (316 Models)	1
23	3630	Sleeve	1
24	4930	Chipblower Pipe	1
25	3628	Thumb Knob	1
26	3635	Adjustment Screw	1
27		Std.Nut	2
28		Std.Washer	2
29		Soc.Cap Screw	2

MOTOR PLATFORM - PART No.SP381

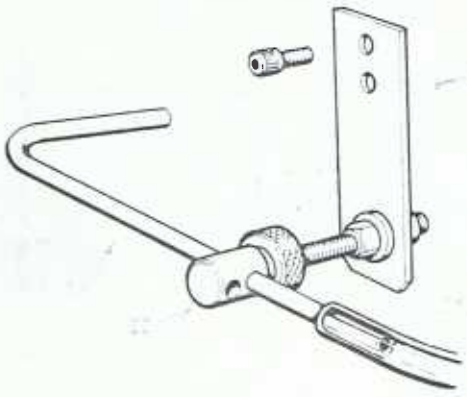
40	SP380	Motor Platform	1
41		Hex.Hd.Screw	2
42	3071	Support Block	2
43	SP383	Mounting Bracket	1
44	2866	Spindle Nut	2
45	2452	Collar	2
46		Soc.Grub Screw	2
47	3074	Packing Block	1
48	3073	Anchor Bar	1
49		Std.Nut	1
50	3068	Washer	1
51	3070	Belt Tensioning Bracket	1
52		Soc.Cap Screw	2

MOTOR PULLEY - NOT ILLUSTRATED

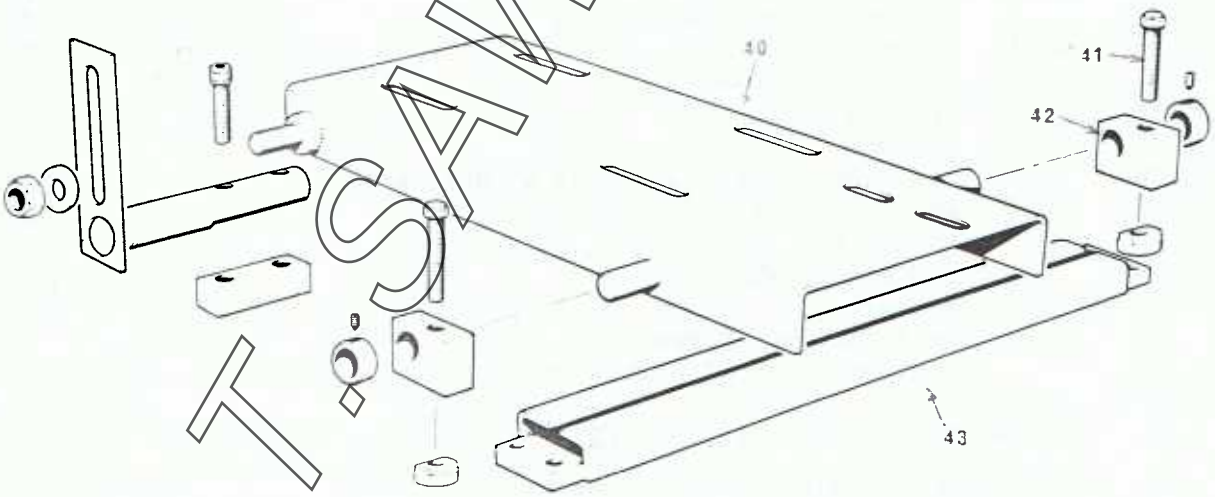
3072A	Motor Pulley - 60Hz Models	1
3266	Motor Pulley - 50Hz Models	1



AIR COMPRESSOR



CHIPBLOWER



MOTOR PLATFORM

UPPER BLADE GUARD (FRONT) - ASSEMBLY No.SP523

ITEM	PART NUMBER	AND DESCRIPTION	No.OFF
1	3084	Blade Guard (Front)	1
2		Rd. Hd. Screw	6
3		Shakeproof Washer	9
4		Soc. Hd. Cap Screw	4
5		Rd. Hd. Screw Recessed	1
6	3078	Guard Spacing Bar	1
7	3077	Guard Tenon Strip	1
8		Hex. Nut	1
9	3106	Guard Slide Pad	2
10	3083	Cleat	4
11	3096	Spring End Plug	1
12	3233	Thumb Screw	1
13	SP384	Handle	1
14	3082	Perspex Guard	1
15		Rd. Hd. Screw Recessed	2

UPPER BLADE GUARD (REAR) - ASSEMBLY No.SM1127

20	SM1128	Blade Guard (Rear)	1
21		Soc. Hd. Cap Screw	1
22		Std. Washer	1
23		Thumb Screw	1
24		Std. Washer	1
25	SM1129	Slide Cover	1

INTERMEDIATE BLADE GUARD - ASSEMBLY No.SM524

NOTE : 316 Models ONLY.

30	SM389	Intermediate Blade Guard	1
31	2711	Thumb Knob	2
32		Hex. Hd. Screw	2
33		Hex. Nut	2
34		Std. Washer	2

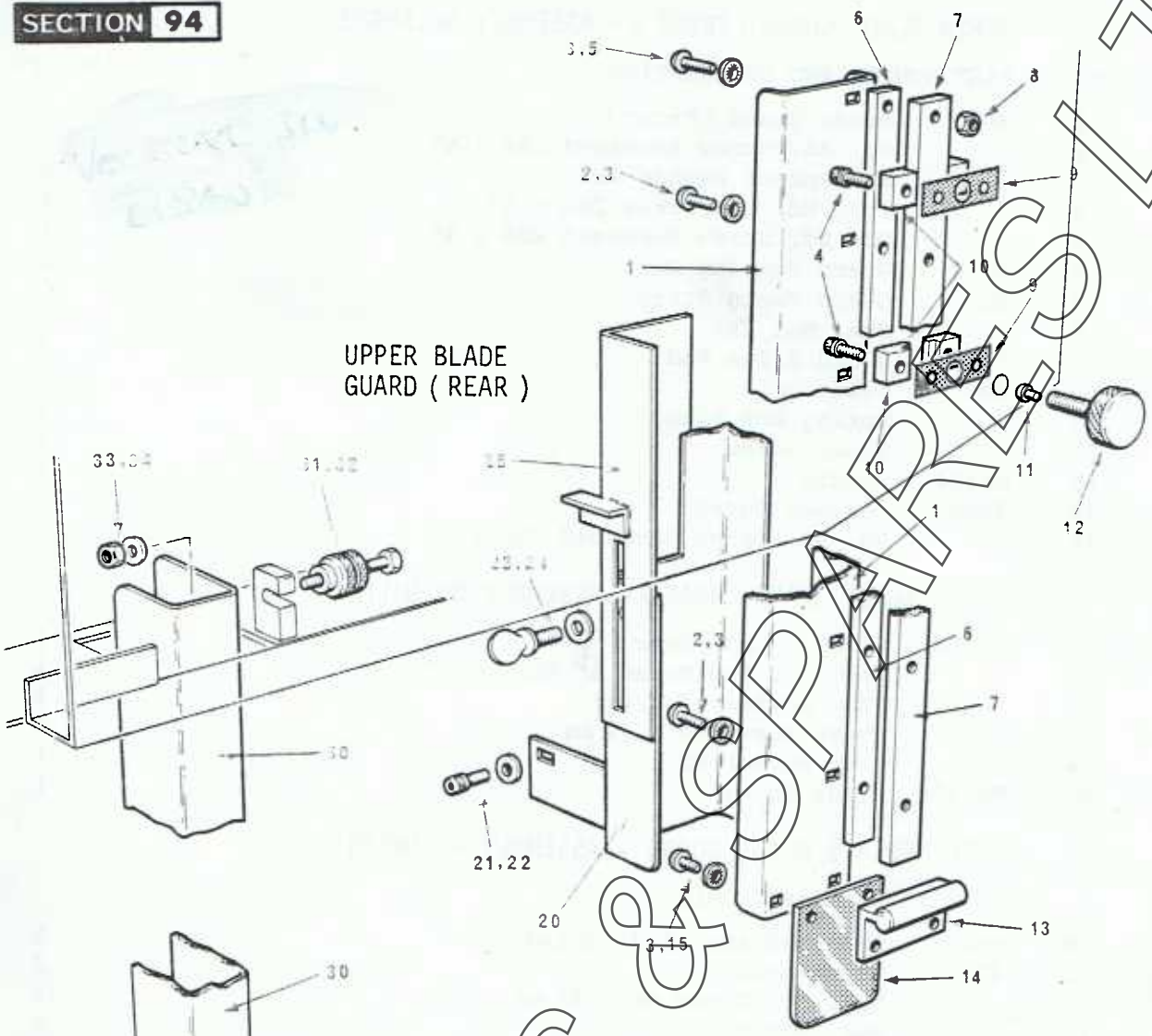
LOWER BLADE GUARD - ASSEMBLY No.SM886

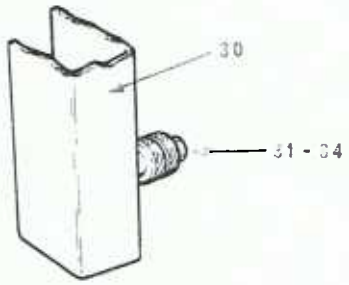
40	SM884	Clamp Plate	1
41	5099	Visor	1
42		Wing Nut	2
43		Std. Washer	5
44	SM885	Lower Guard	1
45		Hex. Hd. Screw	1
46		Hex. Nut	1
47	5100	Spacer	1

THROAT GUARDS - (NOT ILLUSTRATED)

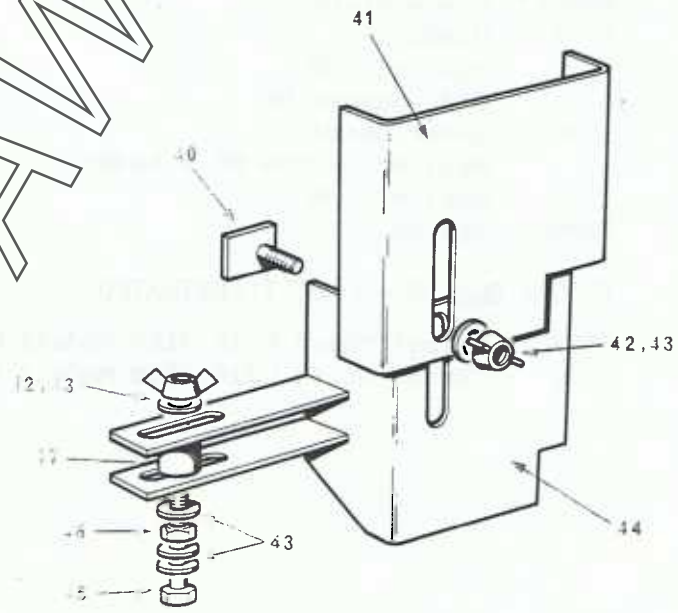
5533	Throat Guard (316/316H Models)	1
5534	Throat Guard (216/216H Models)	1

SECTION 94





INTERMEDIATE BLADE GUARD



LOWER BLADE GUARD