

Photo 1

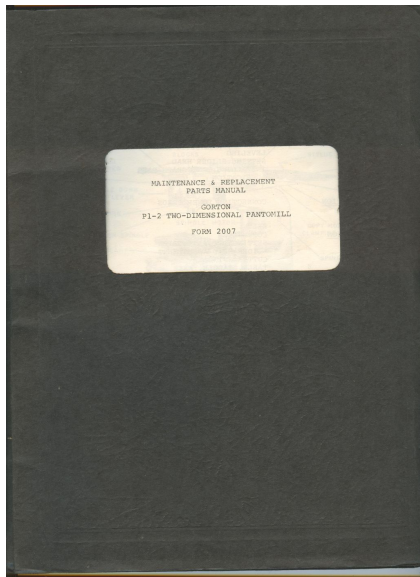


Photo 2

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Photo 3

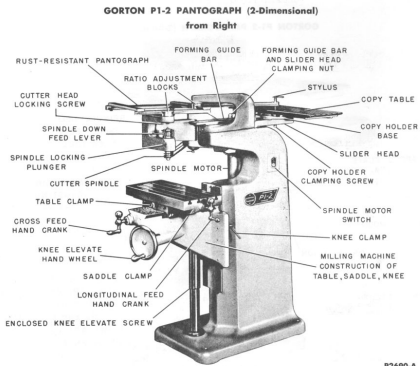
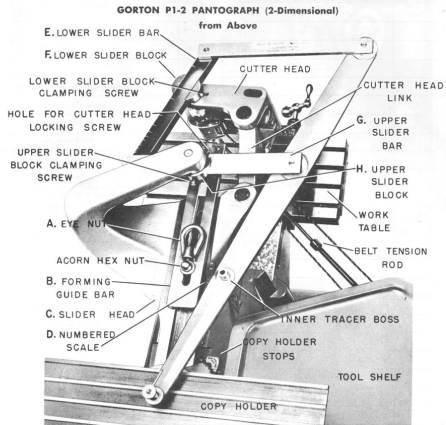
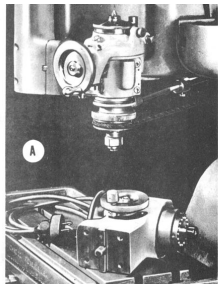


Photo 5



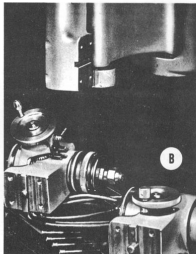
P2690-H

Photo 6

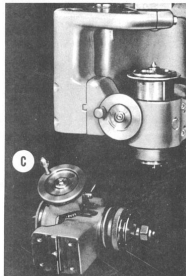


P2389

AND SUPER-SPEED ELECTRIC SPINDLE



P2389-A



P2389-B

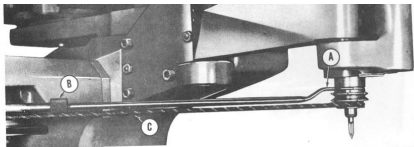
The Gorton Combination Cutter Head permits rapid change-over from belt-driven spindle to 45,000 R.P.M. Super-Speed Electric Spindle.

A. Upper left illustration shows belt-driven spindle in place and Super-Speed Electric Spindle and Cutter Head Bracket ready for installation on machine table.

B. Belt-Driven Spindle has now been removed by taking out four bolts shown lying on machine table.

C. Super-Speed Electric Spindle is now installed with same four bolts, mentioned in "B".

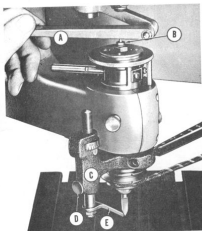
Photo 7



BELT TENSION ROD

P2690-W

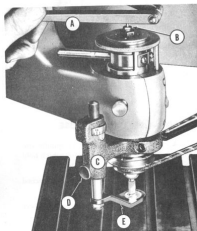
- A. Belt tension adjustment rod fork which engages machined groove at lower end of cutter head.
- B. Belt tension adjustment collar; moves belt tension rod in and out of tension rod sleeve.
- C. Endless fabric spindle belt.



**706-4 DEPTH REGULATOR
SINGLE FOOT**

P2690-5

- A. Hand feed lever for use with depth regulator.
- B. Former point on top of spindle.
- C. Depth regulator bracket with micrometer adjustment knob at upper end. Bracket clamps around lower end of spindle between belt tension rod fork and spindle pulley.
- D. Depth regulator clamping screw.
- E. Single foot rests on top of work close to cutter point.

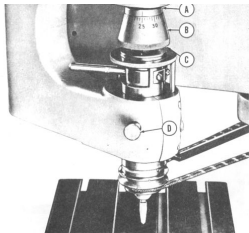


**1243-1 DEPTH REGULATOR
UNI-BALL**

P2690-

- A. Hand feed lever for use with depth regulator.
- B. Former point on top of spindle.
- C. Depth regulator bracket with micrometer adjustment knob at upper end. Bracket clamps around lower end of spindle between belt tension rod fork and spindle pulley.
- D. Depth regulator clamping screw.
- E. Uni-ball foot rests on top of work and encircled cutter.

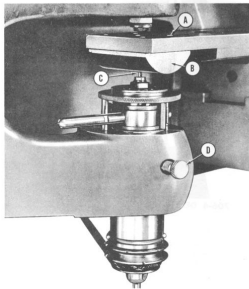
Photo 8



P2690-T

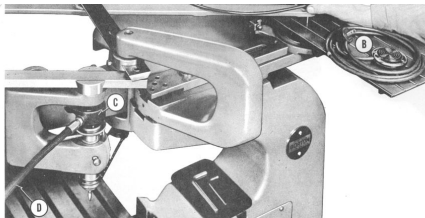
FORMING GUIDE IN USE

- A. Former Bar extended over spindle and four Philister Head Cap Screws which hold Forming Guide to Former Bar.
- B. Solid Convex Forming Guide attached to Former Bar.
- C. Former Point in contact with lower surface of Forming Guide.
- D. Former Sleeve Lock Screw loosened to permit Spindle $\frac{1}{2}$ " free floating movement for work with Forming Guide.



P2690-U

Photo 9



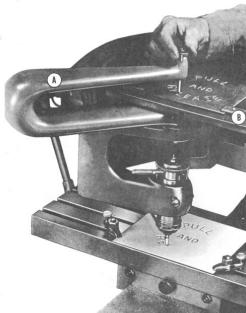
P2690-V

GORTON REMOTE CONTROL SPINDLE FEED 1244-1

A. Electrical Switch Attached to Tracer Stylus which feeds and retracts Spindle.

B. Foot-operated electrical switch which can be used in place of hand-operated switch on tracing style.

C. Air-operated spindle down feed unit, connected by air line (D) to electrically-operated air valve. Maximum stroke, $\frac{1}{4}$ ".



GORTON DIRECT COPYING ATTACHMENT

A. Gorton direct copying attachment connected to upper member of cutter head. Replaces standard pantograph assembly.

B. Copy Table of Direct Copying Attachment mounted on column top in place of slider head assembly.

P2698-A

Photo 10

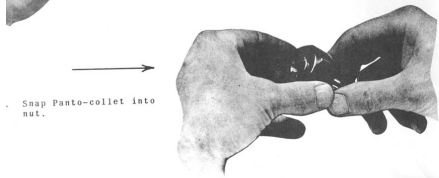
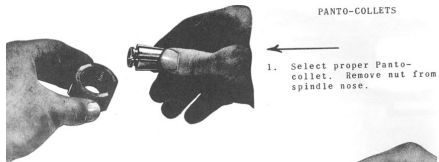


Photo 11

1. Carefully examine the machine to see that it is intact and that it has not been damaged in transit. The P1-2 is shipped boxed tight, not crated, to eliminate dust, dirt or cinders and to prevent anything being thrust through spaces in the crate to damage the machine. After removing box, check all parts with the packing list. Examine all packing paper, excelsior, etc., to make sure that no small parts have been overlooked.

LOCATING THE MACHINE

2. This machine is shipped complete in two units, the column-base and the pantograph. Before installing the pantograph, locate the column-base in a desirable position, centered in front of good window light, with operator's left side toward the window. Daylight is preferable when conditions permit, although good, indirect artificial lighting is usually satisfactory. Machine lamp is available to insure maximum visibility. User makes own installation.

CLEANING

3. Kerosene is preferable for use in cleaning the machine. Use rags free from lint, and fresh kerosene. Wipe entire machine thoroughly and immerse smaller parts. Do not at any time immerse the pantograph, as this will result in damage to components.

LEVELING

4. A flat, solid floor is of primary importance. Place a small machinists' level on the machine table. Shim up base as required. The base is drilled for lag screws used in shipping. These holes may be used for anchor bolts into the floor, although bolting down is not essential. If floor transmits too much vibration from surrounding machinery, good practice is to set machine on insulating pads.

Photo 12

front end of forming guide bar - see "B" on page 5 - can then be pushed down (or gently pried and tapped with wood block) releasing the hinged cutter head and link. The cutter head and link are also held in this "shipping position" when it is desired to operate the P1-2 as a light vertical miller and router with a fixed spindle. Now, with the eye nut removed, move the slider head - "C" on page 5 - to the position which indicates on the numbered scale the ratio of reduction to be used. Scale is on top of slider head at left - see "D" on page 5. Take acorn hex nut from parts box and tighten it on stud in place of eye nut.

INSTALLING PANTOGRAPH BARS

6. Now, holding pantograph bars in position shown on page 5, place slider bar "E" in slider block "F", with index line to the front. Then insert slider bar "G" in slider block "H" with index line on milled flat to the front also, making sure that clamping screws are loosened. Take care that edges of blocks and bars are not dented or nicked in this operation. These parts are carefully fitted and no force is necessary to slip the bars into the blocks, if started properly. After setting for the desired reduction and locking the bars in blocks by means of the clamping screw in each block, the machine is ready for use.

LUBRICATION

7. The problem of lubricating the P1-2 Pantomill is relatively simple and requires no lubrication drawing or chart.
 - a. SPINDLE. Two marked oil holes are provided on top of the cutter spindle. Apply two to four drops of spindle oil, such as Socony Mobil Velocity #10 or Sun Oil Solnus #70, to each oil hole twice daily.

Photo 13

Vactra #2 or Sun Oil SWL #80 should be made. Knee elevate screw nut can be oiled by raising knee all the way up and sliding lower screw shield all the way up.

- c. WAYS. A slight film of clean oil such as that described in paragraph 7b above, should be maintained on all bearing surfaces.
- d. BEARINGS. All pantograph bearings, cutter head and link bearings, idler pulley bearings and motor bearings are grease sealed and require no lubrication. (If motor has lubrication fittings, then grease or oil should be applied as required.)

POWER CONNECTION

CONNECTING POWER LEADS

- 8. When making power connection, be sure that the spindle rotates clockwise when looking down at it from above.

MACHINE OPERATION

BELT

- 9. Mount the belt tension rod into position (see page 7) and V-belt between motor and idler pulleys, and endless fabric belt between idler pulleys and spindle pulley. Belt tension rod should be adjusted so that there is no "whip" action by the belt at high speeds. Too much tension will stretch the belt unduly. The speed plate is mounted on the edge of the large tool shelf.

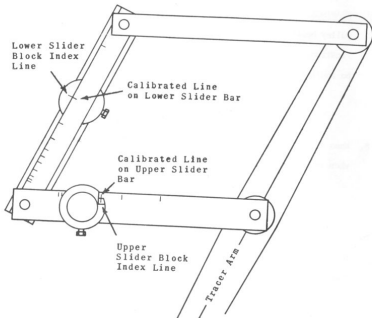
COPYHOLDER

- 10. Mount the copyholder bracket with stop screws facing front of machine. Mount copyholder on this bracket so that it fits snugly against one or the other stop screws, and then tighten copyholder hex head bolt.

Photo 14

SLIDER BAR ADJUSTMENT

11. The lower slider block has an index line on top which should be matched with the proper calibrated line on the lower slider bar. The upper slider block index line should be matched with the proper calibrated line on the upper slider bar.



12. Refer to page 5. You will find calibrations 2, 3, 4, 5, 6 and 8 at "D". When setting the pantograph bars for any reduction, also set the slider head to the closest calibrated figure, and slide this figure into the notch on the top of cutter head mounting bracket. This will give you the maximum cutting area at the required reduction.

Photo 15

Chart 2717 at the back of this book. The setting of the pantograph is then determined from the size of the work to be engraved.

14. Example: If length of copy is 10" and length of finished work is to be 2", divide the finished work dimension into the length of copy dimension ($10 \div 2 = 5$). Therefore, set your pantograph bars at the reduction figure "5". If length of copy is 11" and length of finished work is to be 4", then the reduction is $11 \div 4 = 2.75$. You will note that reduction 2.75 is not marked on the pantograph bars. To find it, refer to table beginning on page 31. If the exact setting does not appear in this table, use formula on page 29 or 30.
15. To obtain accurate reproduction through the pantograph bars, it is essential that the settings be made with a magnifying glass so that the index line on the blocks will be aligned with the calibrations on the bars.

Note: After pantograph has been set accurately and there is an error in parallelism between copy table and machine table, it may be necessary to adjust screw "X" (see page 28).

This will not affect the accuracy of the pantograph and the calibrations.

For odd reductions from 2 to 1 to infinity, table on page 31 is used. All pantomills are not identical and, therefore, it may be necessary to deviate slightly from the dimensions given in the table.

16. It is best after a special reduction has been set, to check the pantograph. First, place a point in the spindle, then raise the table until this point clears it by a fraction of an inch. Next, follow the inside edge of the copyholder with tracing style. If the point follows parallel to the T-slots, the reduction settings are correct. If the point forms

Photo 16

point still runs off, it can be corrected by loosening either or the slider blocks and tapping one way or the other until path of point is true. (See page 28.)

- a. For especially fine settings, put dial indicator rod in spindle nose. Draw up tight and, with indicator button below center of spindle, trace front or back of work table or one of the T-slots. Follow inside edge of copyholder with stylus as described above. This operation establishes accuracy, but does not necessarily result in correct ratio of reduction.
 - b. If reduction ratio has changed due to the above adjustments for accuracy, then the new reduction ratio must be determined by a trial cut, and the resulting deviation from the desired reduction ratio must be compensated for in the diameter of stylus and/or cutter. (Also see paragraph 18a below.)
17. For a 1 to 1 ratio, transfer style and collet from outer boss to inner boss on the tracer arm; set lower slider block on graduation "1-2" and upper slider block on graduation "1".
 18. To set the pantograph, proceed as outlined in paragraph 6, page 12. Never force the pantograph bar slider blocks by striking with a hammer or any other hard object. These blocks are carefully inspected and tested before shipment from factory, and if at any time while setting the pantograph you find these blocks too tight, ascertain the cause. It may be that the clamping nuts are not sufficiently loose, or they may be gummed with oil.
- a. DISTORTING MASTER. Another method often used to compensate for inherent inaccuracies in a specific machine is as follows: by trial cutting first

Photo 17

rework or distort the master to compensate. If this is done carefully, the pantomill will provide extreme repetitive accuracy.

CUTTER SPINDLE

19. The P1-2 cutter spindle has a 1/4" fast feed and a 1/16" slow feed to protect cutter, together with a full floating vertical movement of 1/2" for work with a forming guide on curved surfaces. It is a high precision unit of simple, sturdy construction, self-contained and quickly removable for grinding cutters in place in the spindle. Spindle bearings are not manually adjustable, but automatically compensate for normal wear. Proper lubrication will prevent excessive wear and increase operating efficiency. Should repair or replacement become necessary, we suggest return of the spindle to the factory for overhaul, which will be done promptly and at nominal cost.
 - a. SPINDLE REMOVAL. To remove spindle for any purpose, take out socket head cap screw in the center rear of spindle housing. Spindle housing is of hinged split construction and can easily be opened thereafter.
20. All spindle parts are made of the finest alloy steel, hardened and ground inside and out to precision tolerances. Super-precision preloaded ball bearings eliminate all end play. Spindle top is provided with an inside oil reservoir and an oil filter keeps out dirt. Milled grooves in spindle pulley allow indexing to grind flats on cutters.
 - a. A hinged cutter head as described above, permits spindle removal, making it unnecessary to disturb work. A thumbscrew locks spindle for flat surface engraving and releases it for work with a forming guide.
21. Spindle is either for Gorton taper shank cutters or 5/16" dia. panto-collet type for straight shank cutters, depending upon how the machine was ordered.

Photo 18

located on top of slider head and on top of column at front.

TABLE, SADDLE, KNEE

23. Each unit is provided with a gib and adjusting screws. To tighten gibs, turn adjusting screws, applying equal pressure at all points. When properly adjusted, all play will be eliminated. Table and saddle feed screws are each provided with thrust bearing adjustments to eliminate any play that may develop in the thrust bearings. (Nuts are non-adjustable.) Table, saddle and knee feed screws are each provided with micrometer dials graduated to thousandths of an inch. They are of an adjustable type for setting to zero for quick, accurate reading.
24. IMPORTANT. After machine has been set up for operation, but before taking a cut, make sure the table, saddle, knee and copyholder have been firmly clamped. The table clamp screw has a knurled head and is located on the front of saddle. The saddle clamp is also a knurled screw and is located on right side of saddle under table. The knee clamp is a lever, located on right side rear of knee.

USE OF COPY, MASTERS OR TEMPLATES

25. The originals from which reproductions are made are known by various terms. "Copy" is the term most used, although "Master" is gaining in general usage. Copy applies specifically to the standard brass letters or type which are set up on the copyholder of the machine, and which guide the pantograph through the tracing style in reproducing at cutter point. Shapes as distinguished from characters are also called masters, special copy or templates.
26. Over 800 sizes and styles of special copy are listed in our Small Tools and Accessories Catalog. The examples shown in this catalog will give a good

Photo 19

catalog the setting up and use of standard copy on the machines, the simplified ordering instructions, the suggestions for making up copy in special shapes, etc., will be found helpful.

27. After setting up the copy type in the copyholder and before engraving, be sure that the copyholder is firmly against one of the stop screws in copyholder base. It is then square with the table. T-slots in the machine table and T-slots or dovetail grooves in copyholder are all parallel to front edge of table. This makes it easy to set up work and copy in accurate parallel relation to each other.

COPY TYPE

28. Copy is held on the machine by means of copyholders provided for that purpose. A number of different styles and sizes are available. These are illustrated in the Gorton Small Tools and Accessories Catalog. Where special masters are used exclusively, we recommend Copyholder 8-2. Gorton standard brass copy characters have beveled edges fitting the beveled groove holders. All these copyholders are interchangeable, and can be quickly removed or installed whenever work requires different sizes of copy, etc.

TRACING STYLES

29. Two different kinds of tracing styles are used with the Gorton P1-2 Pantomill. For all cutting of sunk letters and designs from 90° V-groove copy, as shown in our Small Tools and Accessories Catalog, Style No. 3253 (conical point) is used. For cutting sunk letters and designs from square bottom groove copy, also for relief (raised) letters and designs from relief copy, the 25-1 or 795-1 Tracing Style (square nose) sets are used.

Photo 20

30. This style should be kept ground to a conical point of 90° included angle on a Gorton Cutter Grinder by means of the 2/10" dia. collets which can be supplied for this purpose. All sunk V-groove copy is made to 90° angle and if the style is not ground to this angle and kept sharp, the copy type will soon be damaged sufficiently to produce imperfect lettering.
31. Keep copy type grooves clean by rubbing out several times a day with slightly greasy cloth. This takes but a few seconds and permits style to move over the copy with much less operator effort. The style, when placed in the grooves of the copy, should be clamped in its collet on the long arm of the pantograph in such a way that no excessive straining of the pantograph joints is caused. The slight springing when the style is moved from one letter to another will do no harm.

CARE AND USE OF STYLE SETS 795-1, 25-1

32. These are for engraving raised letters and designs, or sunk lettering in which the thickness of line is not uniform as it is with plain block letters. Where the reduction ratio is great, the styles and rollers 25-1 are used. Where the ratio of reduction is not great, and for final finishing, the styles without rollers, 795-1, are used.
33. If the cutter is in the exact ratio of reduction to the styles according to the reduction ratio set on the pantograph, the forms engraved will be accurately proportioned to the forms of the copy. The exact size may be conveniently calculated in decimals of an inch by reducing the diameter marked on the roller in the ratio of reduction to which the pantograph is set. Thus, if the pantograph is set to reduce to one-tenth the size of copy, a cutter .06" dia. must be used with the .6" roller. It is generally

Photo 21

to use the smaller rollers, or styles alone, with corresponding cutters, only when necessary to reach into fine spaces or corners of the work.

USE OF FORMING GUIDE

34. For curved work a hardened steel forming guide is necessary in addition to the flat copy or master template. The forming guide should be the exact opposite of the work, and preferably made of tool steel hardened. For instance, if the work is convex, the forming guide should be concave. Before using, its contour should be matched precisely with the part to be engraved. This is done through the use of lamp black, mechanics blue, etc.
35. The making of forming guides can be avoided in many cases through the use of adjustable forming guides, described in our Pantomill Bulletin. These save the expense of making hardened guides from solid steel blocks.
36. Forming guides may be made by turning on a lathe, shaping on a shaper, milled with a form cutter, or by hand with file or hand grinder.
37. The forming guide is secured to the forming guide holder or bar by means of four small screws.
38. Assuming that the work is clamped to the work table and copy on copyholder, the general procedure is as follows:
 - a. Check to see that cutter point and former point are approximately the same size and shape, especially if cutter point has a small radius. Former point is easily removed for changing sizes.
 - b. Lock spindle floating movement by tightening former sleeve lock screw (see page 8), and locate work in relation to copy.
 - c. Release spindle floating movement by loosening the former sleeve lock screw, and allow former point to come in contact with guide which should be directly above work.

Photo 22

barrel. These two set screws provide the adjustment of spindle housing to spindle diameter. Backing out of set screws reduces the bore diameter of the housing around the spindle. Tightening of set screws expands the spindle housing bore. This adjustment of set screws is especially important when using a forming guide because spindle must be free enough to move up and down to follow the shape of the forming guide. Care should be taken when making such adjustment to see that spindle is not so loose as to cause "cocking". Use a thin piece of paper as a shim and check upper and lower set screws to make sure that spindle bore is held parallel.

- e. Extreme care should be taken when locating forming guide in relation to work. Place a cutter blank having a conical point in the cutter spindle and raise work close to cutter. Now move the cutter point over surface of work by moving tracing style. If the cutter point does not follow the curved surface of the work, move work table in the necessary directions.
- f. When the work is in direct relation to the forming guide, the copy will probably be found out of alignment with work, due to moving the table.
- g. Copy should now be re-located by shifting it back and forth and placing tracing style at extreme points, noting when cutter point locates laterally with work. After lining up, lock the table and do not move again.
- h. Cover forming guide with grease so former point will slide without friction. When this has been done, the engraving can proceed without further thought to the forming guide. The spring-loaded studs in the cutter head will always keep the former point secure against the guide, thus causing the cutter to follow the same course as the guide surface.

GIBS

42. The table and saddle gibs are adjusted by loosening the two lock nuts (per slide) and tightening the socket head screws evenly, then retightening the lock nuts. The knee gib is adjusted with the three socket cap screws. When properly adjusted, the weight of the knee, saddle and table should be sufficient to keep knee from hanging when it is lowered with the handwheel.

P1-2 HEAVY-DUTY PANTOMILL WITH COMBINATION CUTTER HEAD

43. If your machine is the Heavy-Duty Model, it will have the Gorton combination cutter head which is of split construction. By removing four cap screws at lower end of cutter head, spindle, feed works and lower head segment are removed and can be replaced with 45,000 R.P.M. electric spindle in its own lower head segment. See page 6.
44. Combination cutter head, link and spindle are substantially the same as the standard Gorton P2-2, except that spindle has two belt pulleys to provide high spindle speeds. Pantograph bars and slider blocks are interchangeable with the standard Gorton P1-2.
45. Areas covered by the cutter at all reductions are slightly smaller than for the standard P1-2 because of the larger cutter head and link.
46. The same formulae for special reductions can be used for the P1-2 Heavy-Duty Model as for the standard P1-2. Likewise, the reduction table for the standard P1-2 also applies to the P1-2 Heavy-Duty Model.

CUTTER SPINDLE

47. Spindle bearings are preloaded. After several years the spindle may become inaccurate through ball bearing wear. If repair or replacement is necessary, we suggest returning spindle to us for overhaul, which will be

done promptly and at nominal cost. This will make the spindle as accurate as when new.

48. CAUTION. Avoid using cutters with shanks more than .001"-.002" undersize. Undersize cutters require excessive tightening of collet nut to prevent slippage, thus permanently distorting the collets, causing the cutters to run out of true.

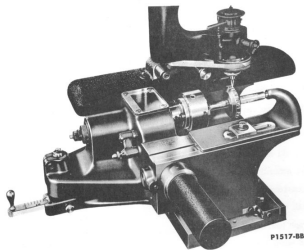
LUBRICATION

49. Two oil holes and two oil cups are located on top of spindle assembly. Oil according to instructions beginning in paragraph 7 on page 13. Occasional application should be made to oil hole in hand wheel bearing with oil such as Socony Mobil Vactra #2 or Sun Oil SML #80. All pantograph bearings, cutter head and link bearings, idler pulley bearings and motor bearings are grease-sealed and require no lubrication. (If motor has lubrication fittings, then grease or oil should be applied as required.)

OPERATING ADJUSTMENTS

50. The spindle, less feed works, is easily removed. Turn lower knurled ring to left until spindle is free. Do not allow spindle nose to drop on table top. When spindle is removed, prevent small chips and grinding dust from lodging around top seal. When replacing spindle, clean its outside surface thoroughly.

On succeeding pages are REDUCTION TABLES and REFERENCE CHARTS, followed by PARTS LISTINGS which will help you identify, by photograph and brief description, all parts contained in the standard Gorton P1-2 Pantomill and Gorton P1-2 Heavy-Duty Pantomill.



727 Roll Attachment mounted on P1-2 Pantomill, with chip apron removed for clearer view. Features: A) correct speed of rotation; B) no forming guide required; C) cutter always at right angles, and D) width of characters variable. Capacity: range of diameters— $3/4$ " to 3 ", length of work piece 7 ". With special attachments, longer rolls may be accommodated; also dia. to $3/8$ ".

INSTALLATION

51. Lower machine table and wipe clean. Clean lower surface of roll attachment. Place attachment on machine table in rear-center position. Match bolt holes in attachment with T-slots of machine table, and tighten bolts in place, making certain the attachment points toward front of machine.) Free lock on (Scale of the attachment points toward front of machine.) Free lock on top slide and lower base to permit attachment to move freely. Remove machine belt and belt tension rod (fork fits against spindle) by loosening slip nut. Lock spindle in lowest position. Next, insert dowel pins of attachment adapter to cutter head with screws. Replace belt tension rod, place belt over pulleys and tighten slip nut to correct belt tension. Install connecting link between adapter and roll attachment. Note: connecting links of various lengths are provided so cutter spindle can be positioned along length of work piece. It may be necessary to alternate the use of connecting links to cover the entire length of the work piece.

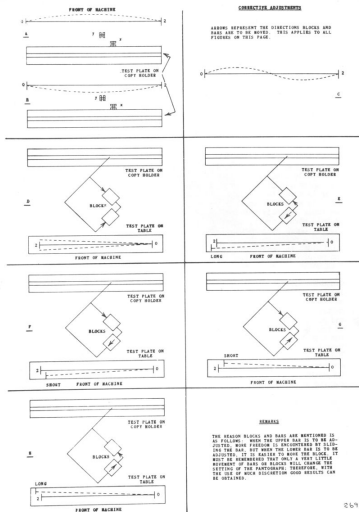
OPERATION

52. Rotation of attachment spindle is accomplished by a steel band running over rollers, under sufficient tension to prevent slippage of the spindle. The band is adjusted before leaving the factory, and should not require any attention for a long time. If this band should require tightening, remove the tubular shields by loosening the small set screws. The tension adjusting screws can then be adjusted to exert more tension on the band. Back off hex nut to allow screw to turn. Then adjust tension by rotating screw with screwdriver. Retighten hex nut. Note: do not move hex bolt (located above adjusting screw) except to change bands.
- a. For mounting work on the attachment spindle, tension on the band should be released by means of the small lever with plunger locking pin, bringing it to an up-position. The spindle and work can then be rotated freely without any movement of the carriage slide, and the work can then be properly lined up and lever returned to its locked position, which will automatically tighten the band to its original tension. As the lever is moved to its locked position, the work may rotate slightly, and if it is necessary to line the job up accurately with the cutter, move the table slightly with the table screw. Work placed on the machine may be held with a chuck, arbor or special fixture, and should be accurate to .001". Check attachment to see that it runs true with the copyholder by placing a point in the spindle, and moving tracing style along edge of copyholder to see if the point follows edge of roll to be engraved. If the point does not follow properly, loosen fastening bolts and adjust attachment on table until roll is parallel with spindle movement.
- b. Measure diameter of roll to be engraved, loosen brass thumb screws holding engraved scale, and set scale for proper diameter. Each graduation on scale is for 1/16" of diameter (graduations are approximate). Then center work with master. Replace point in machine spindle with cutter and proceed with engraving the same as on flat work, with the exception of taking lighter cuts. Cutter must be kept sharp, even more so than for highly accurate flat engraving to insure a clean, even cut. Important: Ball bearing slides must be kept clean and free from chips, and it is recommended that a brush be used to remove chips. While slides are protected by shields and aprons, do not use an air blast in cleaning the machine, as this may force some chips into the ball bearings, causing the slides to stick, possibly damaging them.
53. When roll attachment is not in use, lock top and lower base slides and release tension on steel bands.

CALCULATIONS--MASTER

54. The dimensions of the flat master utilized in roll attachment work are obtained as follows: the length of the master character or form will be the circumference (or portion of the circumference) of the work piece multiplied by the reduction (ratio) used. Example: 2" dia. part at 2 to 1 ratio - circumference $6.2832 \times 2 = 12.5664$ master dimension.

Photo 28



2690-1

Photo 29

FORMULA FOR SPECIAL REDUCTIONS

(From 2-1 to 40-1)

CONSTANTS
(A = 20.0390
(B = 12.7450
(C = 10.0195
(D = 4.2483

FOR SETTING ON LOWER SLIDER BAR

- Step 1. $A + \text{Required Reduction} = E$
Step 2. $C - E = \text{Setting Distance from Graduation}$
"2" on Lower Slider Bar in Inches.

FOR SETTING ON UPPER SLIDER BAR

- Step 3. $B + \text{Required Reduction} + 1 = F$
Step 4. $D - F = \text{Setting Distance from Graduation}$
"2" on Upper Slider Bar in Inches.

EXAMPLE OF 9 to 1 REDUCTION

- Step 1. $20.0390 + 9 = 2.2266$
Step 2. $10.0195 - 2.2266 = 7.793$ inches from
Graduation "2" on Lower Slider Bar.
Step 3. $12.7450 + 9 + 1$ or $10 = 1.2745$
Step 4. $4.2483 - 1.2745 = 2.974$ inches from
Graduation "2" on Upper Slider Bar.

Photo 30

FORMULA FOR SPECIAL REDUCTIONS

(From 1-1 to 2-1)

$$(A = 10.0195$$

CONSTANTS $(B = 12.745$

$$(C = 6.3725$$

FOR SETTING ON LOWER SLIDER BAR

Step 1. $A + \text{Required Reduction} = D$

Step 2. $A - D = \text{Setting Distance from Graduation}$
"1" and "2" on Lower Slider Block
in Inches

FOR SETTING ON UPPER SLIDER BAR

Step 3. $B + \text{Required Reduction} + 1 = E$

Step 4. $C - E = \text{Setting Distance from Graduation}$
"1" on Upper Slider Bar in Inches

EXAMPLE OF 1.8 TO 1 REDUCTION

Step 1. $10.0195 + 1.8 = 5.5559$

Step 2. $10.0195 - 5.5559 = 4.4536$ inches from
Graduation "1" and "2" on Lower
Slider Bar.

Step 3. $12.745 + 1.8 + 1$ or $2.8 = 4.5518$

Step 4. $6.3725 - 4.5518 = 1.821$ inches from
Graduation "1" on Upper Slider Bar.

Photo 31

REDUCTION TABLE FOR P1-2

REDUCTION	LOWER BAR INCHES	UPPER BAR INCHES	LOWER BAR MILLIMETERS	UPPER BAR MILLIMETERS
2-1	0.000	0.000	00.00	0.00
2.1-1	0.477	0.137	12.12	3.48
2.2-1	0.911	0.265	23.14	6.74
2.3-1	1.307	0.386	33.19	9.81
2.4-1	1.670	0.500	42.42	12.69
2.5-1	2.004	0.607	50.90	15.41
2.6-1	2.312	0.708	58.73	17.98
2.7-1	2.598	0.804	65.98	20.41
2.8-1	2.863	0.894	72.71	22.72
2.9-1	3.109	0.980	78.98	24.90
3-1	3.340	1.062	84.83	26.98
3.1-1	3.555	1.140	90.30	28.95
3.2-1	3.757	1.214	95.44	30.83
3.3-1	3.947	1.284	100.26	32.62
3.4-1	4.126	1.352	104.79	34.33
3.5-1	4.294	1.416	109.07	35.97
3.6-1	4.453	1.478	113.11	37.53
3.7-1	4.604	1.537	116.93	39.03
3.8-1	4.746	1.593	120.55	40.46
3.9-1	4.881	1.647	123.98	41.84
4-1	5.010	1.699	127.25	43.16
4.1-1	5.132	1.749	130.35	44.43
4.2-1	5.248	1.797	133.31	45.65

REDUCTION TABLE FOR P1-2

REDUCTION	LOWER BAR INCHES	UPPER BAR INCHES	LOWER BAR MILLIMETERS	UPPER BAR MILLIMETERS
4.3-1	5.359	1.044	136.13	46.83
4.4-1	5.465	1.088	138.82	47.96
4.5-1	5.566	1.931	141.39	49.05
4.6-1	5.663	1.972	143.84	50.10
4.7-1	5.756	2.012	146.20	51.11
4.8-1	5.845	2.051	148.46	52.09
4.9-1	5.930	2.088	150.62	53.04
5-1	6.012	2.124	152.70	53.95
5.1-1	6.090	2.159	154.69	54.84
5.2-1	6.166	2.193	156.61	55.69
5.3-1	6.239	2.225	158.46	56.52
5.4-1	6.309	2.257	160.24	57.53
5.5-1	6.376	2.288	161.95	58.10
5.6-1	6.441	2.317	163.60	58.86
5.7-1	6.504	2.346	165.20	59.59
5.8-1	6.564	2.374	166.74	60.30
5.9-1	6.623	2.401	168.23	60.99
6-1	6.680	2.428	169.66	61.66
6.1-1	6.734	2.453	171.05	62.31
6.2-1	6.787	2.478	172.40	62.95
6.3-1	6.839	2.502	173.70	63.56
6.4-1	6.888	2.526	174.97	64.16
6.5-1	6.937	2.549	176.19	64.74

Photo 33

REDUCTION TABLE FOR P1-2

REDUCTION	LOWER BAR INCHES	UPPER BAR INCHES	LOWER BAR MILLIMETERS	UPPER BAR MILLIMETER
6.6-1	6.983	2.571	177.38	65.31
6.7-1	7.029	2.593	178.53	65.87
6.8-1	7.073	2.614	179.64	66.40
6.9-1	7.115	2.635	180.73	66.93
7-1	7.157	2.655	181.78	67.44
7.1-1	7.197	2.675	182.81	67.94
7.2-1	7.236	2.694	183.80	68.43
7.3-1	7.274	2.713	184.77	68.90
7.4-1	7.312	2.731	185.71	69.37
7.5-1	7.348	2.749	186.63	69.82
7.6-1	7.383	2.766	187.52	70.26
7.7-1	7.417	2.783	188.39	70.70
7.8-1	7.450	2.800	189.24	71.12
7.9-1	7.483	2.816	190.07	71.53
8-1	7.515	2.832	190.87	71.94
9-1	7.793	2.974	197.94	75.53
10-1	8.016	3.090	203.60	78.48
11-1	8.198	3.186	208.22	80.93
12-1	8.350	3.268	212.08	83.01
13-1	8.478	3.338	215.34	84.78
14-1	8.588	3.399	218.13	86.32
15-1	8.683	3.452	220.56	87.67
16-1	8.767	3.499	222.68	88.86

Photo 34

SURFACE FEET PER MINUTE

Surface Feet per Minute	Diameter					
	1/16	1/8	5/16	1/4	5/16	3/8
30	1833	917	611	458	367	306
40	2445	1222	815	611	489	408
50	3056	1528	1019	764	611	509
60	3667	1833	1222	917	733	611
70	4278	2139	1426	1070	856	713
80	4889	2445	1630	1222	978	815
100	6112	3056	2037	1528	1222	1019
125	7641	3820	2546	1910	1528	1274
150	9169	4584	3056	2292	1833	1527
175	10714	5348	3565	2674	2139	1784
200	12224	6112	4074	3056	2444	2036
250	15281	7640	5092	3820	3055	2548
300	18337	9168	6111	4584	3666	3057
400	24450	12224	8148	6112	4888	4076
500	30562	15280	10185	7640	6110	5095
700	42787	21392	14259	10696	8554	7133
900	55012	27504	18333	13752	10998	9170

Photo 35

Material	Tensile Strength	Tungsten Carbide Tantalum Carbide Ft. per Min.			High Speed Ft. per	
		Dry	Wet	Type of Coolant	Dry	Wet
Cast Iron	18000	250			90	
Average Brinell 150-170	26000	275			110	
C.I. up to 1.5% Nickel	20000	275			70	
Brinell 170-195	28000	500			80	
C.I. up to 1% Cr. 3.5% Ni.	30000	210			65	
Brinell 200-210	36000	230			70	
Semi Steel. 20-30%						
Steel Scrap with 2% Si. or Better	30000	175			62	
Brinell 170-195	36000	200			72	
Steels						
Bessemer Screw Stock	70000	220	Cutting		160	
S.A.E. #1112	90000	230	Oil		170	
Free Cutting Bessemer Screw Stock	70000	240	Cutting		175	
High Sulphur Content	90000	260	Oil		185	
#2 Bessemer	70000	270	Cutting		165	
High Sulphur	90000	300	Oil		175	
Ultra Cut High Manganese, Same Machinability as #2 Bessemer	90000	270	Cutting		180	
	110000	300	Oil		200	
Open Hearth Screw Stock	70000	250	Cutting		135	
S.A.E. #1120	85000	260	Oil		145	
Soft Forging Steel						
S.A.E. #1020 Low Sulphur For Carburizing	63000	240	Soda		110	
	80000	250	Compound		120	
S.A.E. #1045	95000	200	Soda		80	
	125000	240	Compound		90	
Alloy Steels 3.5% Ni.	80000	165	Soda		110	
S.A.E. #2315 for Gear Blanks	115000	175	Compound		120	
Chrome Ni. up to .90 Cr. and 1.5 Ni. S.A.E. #3120	80000	140	Soda		90	
For Heat Treated Bolts and Gear Blanks	110000	160	Compound		100	
Aluminum						
Pure Cast Aluminum #43	19000	400	Kerosene & Lard Oil		220	
Commercially Hard Temper Aluminum #2 SH.	24000	200	Kerosene & Lard Oil		150	
		250			140	
Dural High Tensile #17 ST.	58000	275	Soluble Oil		190	
		300			200	
Copper						
Copper One-Half Hard Com- mercial	31000	180	Soluble Oil		100	
		200			120	
Brass						
Brass, Cast Yellow	20000	400	Soluble Oil	200		
		600		220		
Brass One-Half Hard Com- mercial		250	Soluble Oil	135		
		300		165		
Bronze						
Bronze, Gun Metal	35000	200	Soluble Oil		130	
		220			150	

Photo 36

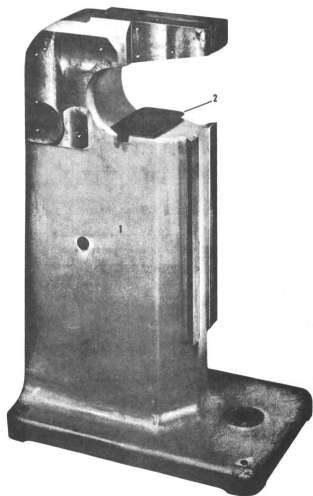


Photo 38

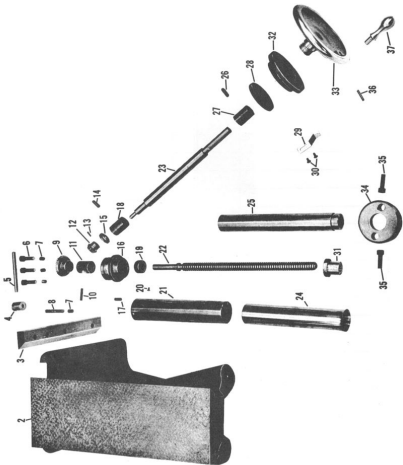


Photo 39

Gorton Parts.		KNEE COMPONENTS		an
Fig. No.	Part Name	Part No.	Fig. No.	Part Name
2	Knee	19190	31	Elevate Nut
3	Knee Gib	19208	32	Knee Elevate Dial
4	Knee Clamp Nut	7534	33	Elevate Handwheel
5	Pin Handle for Above	12634	34	Elevate Screw Bracket Base
6	Gib Cap Screws (3)	K-2030	35	Hex Head Cap Screws (2)
7	Lock Screws (4)	K-219	36	Roll Pin
8	Stud	19207	37	Machine Handle
9	Elevate Bevel Gear	19209		
10	Roll Pin	K-5670		
11	Oilite Bearing	K-5656		
12	Pinion	19224		
13	Roll Pin	K-5651		
14	Socket Set Screws (2)	K-198		<u>PARTS NOT SHOWN</u>
15	Bearing Thrust Washer	19199	16a	Socket Set Screws (2)
16	Elevate Bearing Housing	19198	22a	Washer
17	Dowel Pin	K-3358	35a	Washers (2)
18	Oilite Bushing	K-5658		
19	Thrust Bearing	K-5659		
20	Button Head Screw	K-5601		
21	Elevate Screw Upper Sleeve	19194		
22	Elevate Screw	19195		
23	Elevate Handwheel Shaft	21577		
24	Elevate Screw Lower Sleeve	19193		
25	Elevate Screw Bracket	19191		
26	Socket Set Screw	K-198		
27	Elevate Shaft Bushing	21579		
28	Knee Dial Lock Nut	19203		
29	Index Bracket	19204		
30	Button Head Screws (2)	K-5387		

Photo 40

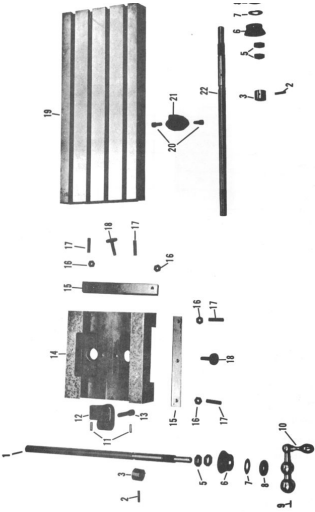


Photo 44

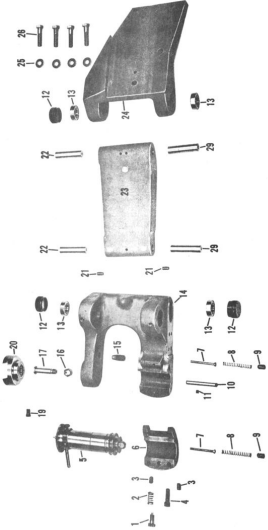


Photo 45

Fig. No.	Part Name	Part No.	Fig. No.	Part Name
1	Former Sleeve Lock Screw	21671		
2	Spring	9448		
3	Socket Set Screws (2)	20579		
4	Socket Cap Screw	K-144		
5	Cutter Spindle (Collet)	1189-7		
6	Cutter Head Cap	19231		
7	Former Sleeve Lift Pins (2)	8729		
8	Springs for Above (2)	9162		
9	Socket Set Screws (2)	K-2404		
10	Dowel Pin	K-5804		
11	Set Screw	K-187		
12	Bearing Retainer (3)	19228		<u>PARTS NOT SHOWN</u>
13	Ball Bearings (4)	K8-5197	2a	Locking Plug
14	Cutter Head	19226	20a	Bearings (2)
15	Cutter Head Lock Screw	21549	20b	Button Head Cap Screw (3)
16	Flex Lock Nut	22479	20c	Socket Cap Screw
17	Bearing Stud	22470	22a	Spacers (2)
19	Locking Screw	K-7091	24a	Socket Set Screw
20	Lower Slider Block	22481	29a	Spacers (2)
21	Socket Set Screws (2)	K-198		
22	Upper Link Studs (2)	19229		
23	Cutter Head Link	19227		
24	Link Pivot Bracket	19237		
25	Washers (4)	K-453		
26	Hex Head Cap Screws (4)	K-270		
29	Lower Link Studs (2)	21525		

Photo 46

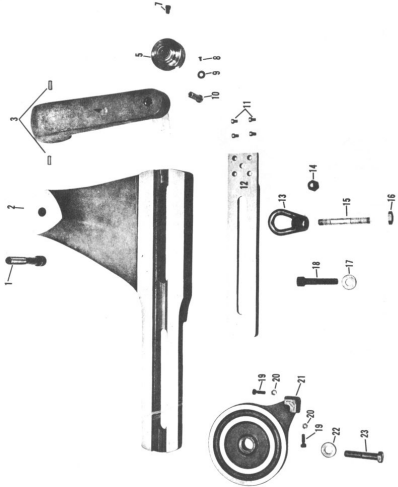


Photo 48

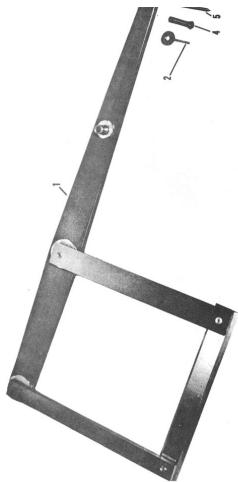


Photo 50

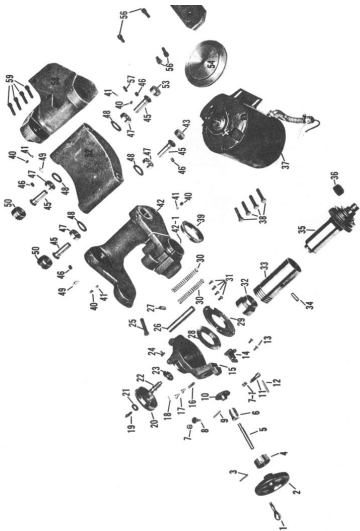
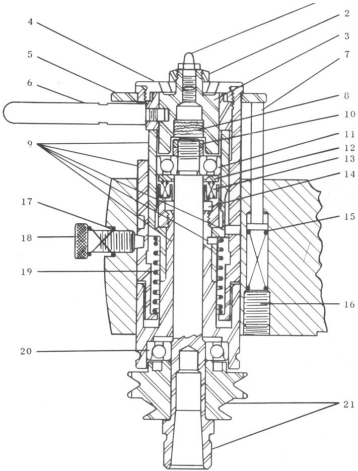


Photo 51

Gorton Parts.		COMBINATION CUTTER HEAD		ans
Fig. No.	Part Name	Part No.	Fig. No.	Part Name
1	Machine Handle	K-538		
2	Handwheel	10995	57	Socket Set Screw
3	Taper Pin	K-492		
4	Collar	6381	58	Link Pivot Bracket
5	Shaft	6355		
6	Bushing	6354	59	Socket Cap Screws (4)
7	Lock Screw Spring	6415		
7-1	Lock Screw Spring	6414		
8	Head Screw	6357		
9	Taper Pin	K-463		
10	Gear	6364		
11	Spindle Lock Screw	6161		
12	Lock Screw Pin	7516		
13	Flat Head Screws (2)	K-363		
14	Spindle Barrel Guide	6247		
15	Spindle Barrel Yoke	6352		<u>PARTS NOT SHOWN</u>
16	Socket Set Screw	K-2262		
17	Oil Gaps (2)	K-513	22a	Dowel Pin
18	Dowel Pin	12610		
19	Former Pin	6199	27a	Cap Screws (2)
20	Spindle Barrel Cap	6168		
	Lock Nut	6220	39a	Belt Tension Clip
22	Feed Stop Screw	6192		
23	Stop Screw Nut	6206	59b	Belt Tension Rod Coupling
24	Feed Stop Key	6222		
25	Hex Head Cap Screw	K-1615	39c	Belt Tension Rod - Adjustable
26	Cutter Head Guide Stud	6169		
27	Set Screws (2)	K-194	42a	Dowel Pin
28	Spindle Feed Gear	17894		
29	Spindle Feed Yoke Plate	6382	42b	Socket Cap Screws (4)
30	Former Yoke Springs (2)	6361		
31	Flat Head Screws (4)	K-363	42c	Ball Bearing Stud Rushing
32	Spindle Barrel Plug	6194		
33	Spindle Barrel - Outer	17895	59a	Raising Block
34	Spindle Barrel Guide Pin	6139		
35	Spindle Assembly	698-4	59b	Socket Cap Screw (6)
36	Collar Nut	K-5425		
37	1/3 H.P. Drive Motor	E-1160	59c	Dowel Pin (2)
38	Hex Head Cap Screws (4)	K-258		
39	Belt Tension Clip Adapter	10154		
40	Socket Set Screws (4)	K-218		
41	Brass Plugs (4)	11996		
42	Cutter Head	19100		
42-1	Cutter Head Bracket	19101		
43	End Nut	6358		
44	Not Used			
45	Link Studs (4)	6357		
46	Socket Set Screws (4)	K-198		
47	Ball Bearings (4)	KB-27		
48	Felt Washers (4)	6231		
49	Grease Fittings (2)	K-2023		
50	Adjustable Mats (2)	6359		
52	Cutter Head Link	6222		
53	Link Plug	6611		
54	Motor Pulley	21831		
55	Motor Bracket	21455		
56	Socket Cap Screws (4)	K-145		

Photo 52



The Manufacturer cannot be held responsible for the satisfactory performance of any spindle which has been repaired in the field.

Photo 53

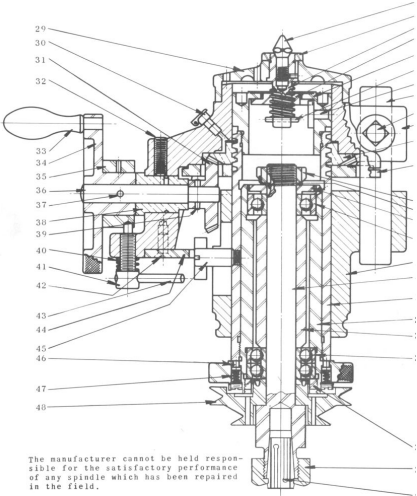
Order by Gorton Part Number
and Name. Always Use Genuine
Gorton Parts.

SPINDLE ASSEMBLY

Machi
an

Fig. No.	Part Name	Part No.	Fig. No.	Part Name
1	Former Point	CP-119		
2	Hex Head Nut	1492		
3	Spindle Feed Cam	20485		
4	Former Sleeve Cap	8701		
5	Former Sleeve Collar	8705		
6	Spindle Feed Lever	20487		
7	Former Sleeve Lift Pin (2)	8729		
8	Felt Plug	11459		
9	Former and Spindle Sleeves	CP-198		
10	Spindle Lock Nut (2)	8699		
11	Upper Ball Bearing	KB-3		<u>PARTS NOT SHOWN</u>
12	Thrust Washer	8524	3a	Spindle Feed Stop Pin
13	Spindle Thrust Spring (3)	8630	6a	Cam Bushing
14	Spindle Sleeve Nut	8518	9a	Phillister Head Cap Screws (2)
15	Former Sleeve Lift Spring (2)	9762	9b	Spindle Feed Stop Spring
16	Socket Set Screws (2)	K-2404	9c	Thumb Screw
17	Spring	9448	18a	Locking Plug
18	Former Sleeve Lock Screw	21670	21a	Collet Type Cutter Spindle & Pu
19	Spindle Feed Lift Spring	9072		
20	Lower Ball Bearing	KB-6		
21	Taper Shank Cutter Spindle & Pulley	CP-424		

Photo 54



The manufacturer cannot be held responsible for the satisfactory performance of any spindle which has been repaired in the field.

Photo 55

Fig. No.	Part Name	Part No.	Fig. No.	Part Name
1	Former Point	6199	33	Machine Handle
2	Lock Nut	6220	34	Handwheel
3	Feed Screw	6192	35	Collar
4	Feed Screw Nut	6206	36	Spindle Feed Shaft
5	Spindle Barrel Plug	6194	37	Taper Pin
6	Drill Rod Pin	12610	38	Feed Shaft Bushing
7	Feed Stop Key	6232	39	Taper Pin
8	Gutter Head Stud	6169	40	Lock Screw Spring
9	Socket Set Screw	K-3222	41	Spindle Lock Screw
10	Spindle Barrel Yoke	6352	42	Flat Head Machine Screw (2)
11	Spindle Feed Gear	17894	43	Lock Screw Handle
12	Spindle Feed Yoke Plate	6382	44	Spindle Barrel Guide
13	Ball Bearing Lock Nut	K-84	45	Spindle Barrel Guide Pin
14	Ball Bearing Lock Washer	K-90	46	Lock Plunger (4)
15	Dust Washer	9087	47	Spring (4)
16	Ball Bearing	KB-20	48	Spindle Pulley
17	Cutter Head Bracket	19101		
18	Cutter Spindle	18505		
19	Spindle Barrel--Outer	17895		PARTS NOT SHOWN
20	Spindle Barrel--Inner	18508	3a	Drill Rod Pin
21	Ball Bearing Spacer	18509	10a	Thumb Screw
22	Ball Bearings (1 pair)	KB-25	10b	Former Yoke Spring (2)
26	Ball Bearing Lock Nut	9086	10c	Lock Screw Spring
27	Collet Nut	K-5425		
28	Panto-Collet	K-5423		
29	Spindle Barrel Cap	6168		
30	Oil Cap (2)	K-515		
31	Spindle Feed Gear	6364		
32	Socket Set Screw	K-2262		

Photo 56

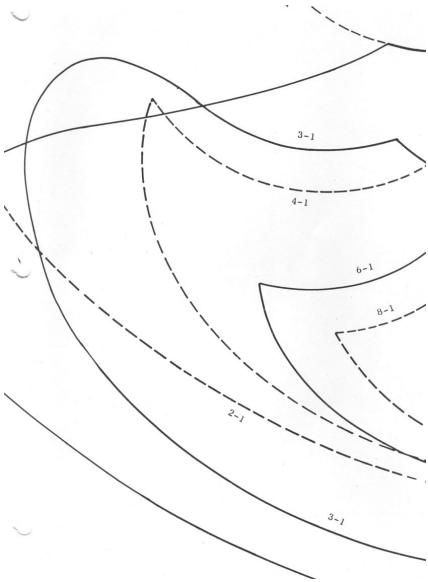


Photo 57

