Photo 1

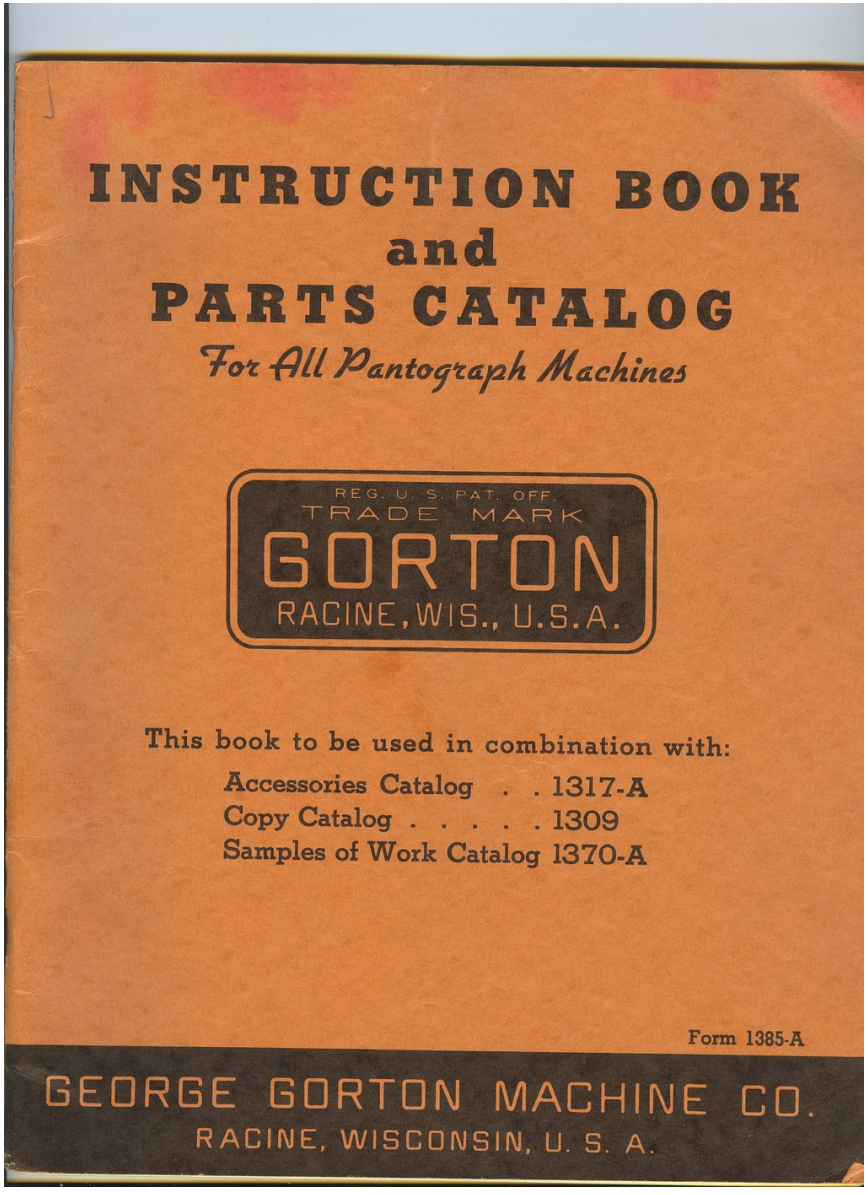
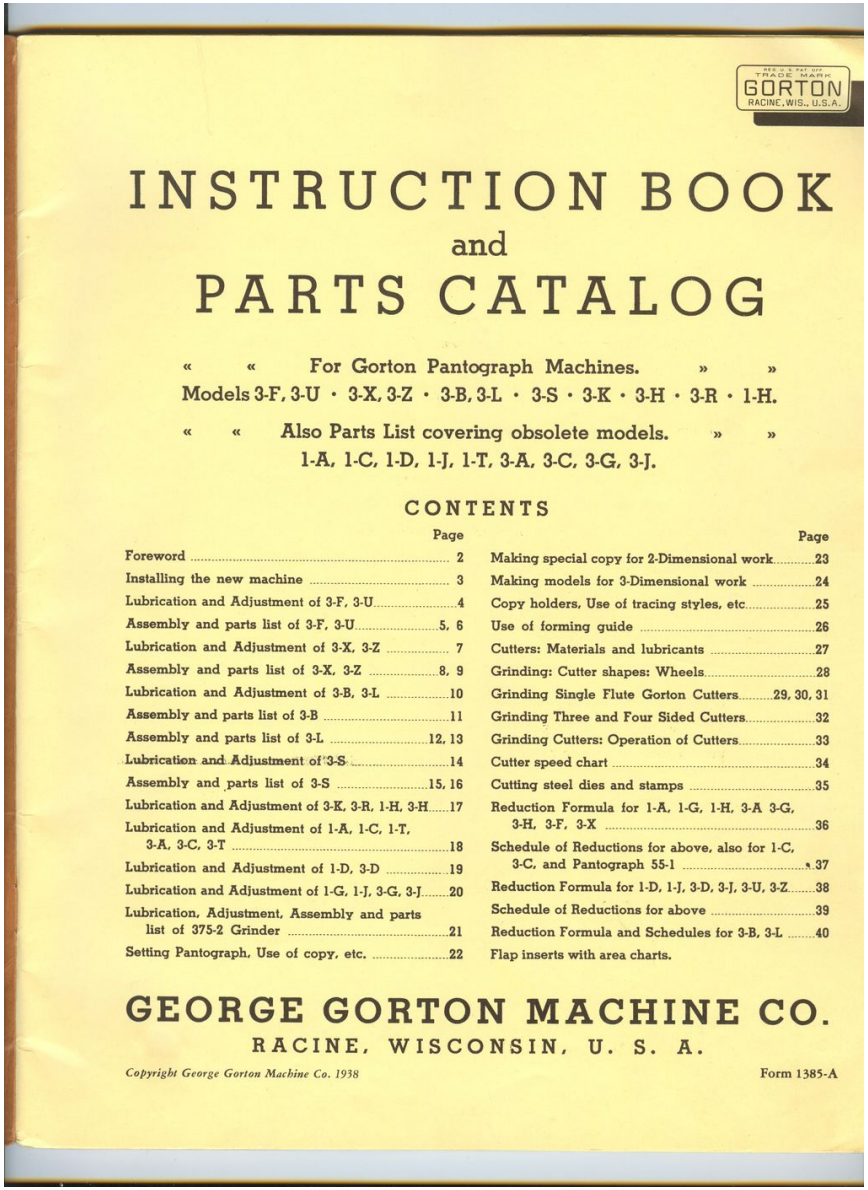

INSTRUCTION BOOK
and
PARTS CATALOG
For All Pantograph Machines
REG. U. S. PAT. OFF.
TRADE MARK
GORTON
RACINE, WIS., U.S.A.
This book to be used in combination with:
Accessories Catalog . . 1317-A
Copy Catalog 1309
Samples of Work Catalog 1370-A
Form 1385-A
GEORGE GORTON MACHINE CO.
RACINE, WISCONSIN, U. S. A.

Photo 2



GORTON
RACINE, WIS., U.S.A.

INSTRUCTION BOOK
and
PARTS CATALOG

« « For Gorton Pantograph Machines. » »
Models 3-F, 3-U · 3-X, 3-Z · 3-B, 3-L · 3-S · 3-K · 3-H · 3-R · 1-H.

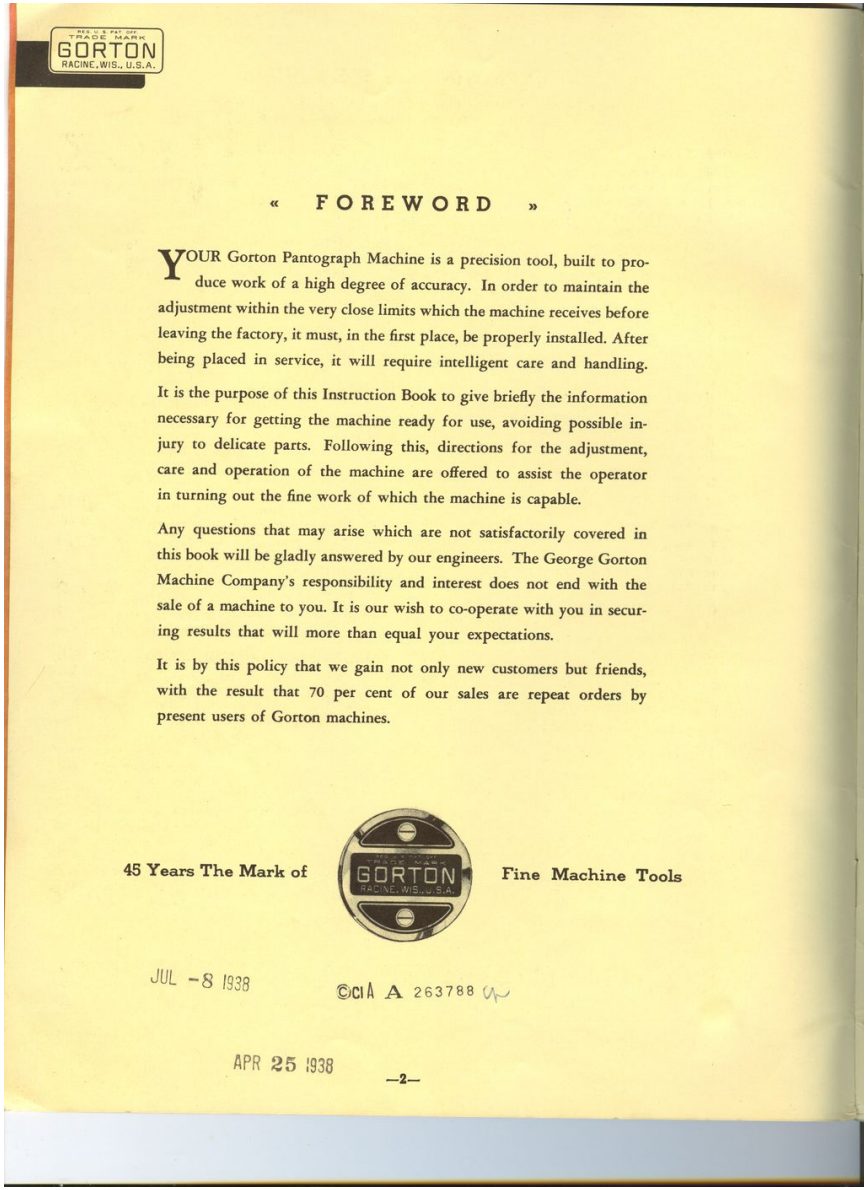
« « Also Parts List covering obsolete models. » »
1-A, 1-C, 1-D, 1-J, 1-T, 3-A, 3-C, 3-G, 3-J.

CONTENTS

GEORGE GORTON MACHINE CO.
RACINE, WISCONSIN, U. S. A.

Form 1385-A

Photo 3



GORTON
RACINE, WIS., U.S.A.

« FOREWORD »

YOUR Gorton Pantograph Machine is a precision tool, built to produce work of a high degree of accuracy. In order to maintain the adjustment within the very close limits which the machine receives before leaving the factory, it must, in the first place, be properly installed. After being placed in service, it will require intelligent care and handling.

It is the purpose of this Instruction Book to give briefly the information necessary for getting the machine ready for use, avoiding possible injury to delicate parts. Following this, directions for the adjustment, care and operation of the machine are offered to assist the operator in turning out the fine work of which the machine is capable.

Any questions that may arise which are not satisfactorily covered in this book will be gladly answered by our engineers. The George Gorton Machine Company's responsibility and interest does not end with the sale of a machine to you. It is our wish to co-operate with you in securing results that will more than equal your expectations.

It is by this policy that we gain not only new customers but friends, with the result that 70 per cent of our sales are repeat orders by present users of Gorton machines.

45 Years The Mark of GORTON Fine Machine Tools

JUL -8 1938

©CIA A 263788

APR 25 1938

Photo 4

UNPACKING and ERECTING

Note: Disregard paragraphs 5 and 6 for 3-B, 3-L and 3-S machines. These machines are shipped with pantograph in place.

1. UNPACKING

Examine the box in which the machine is received to see that it is intact and that the machine has not been damaged in transit. All Gorton machines are shipped *boxed tight,* not crated, to eliminate dust or cinders and to prevent anything being thrust through the spaces of a crate to damage the machine. After removing box, check up all parts with the packing list. Carefully examine all packing paper and excelsior to make sure that no small parts have been overlooked.

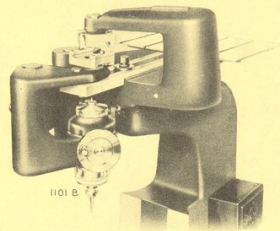


Fig. 1—Cutter Head Locked for Shipping

2. CLEANING

For cleaning the machine of slushing grease, kerosene is preferable. The container used should be thoroughly cleaned before filling. Rags are better than waste as they leave no lint. When removing the grease from Pantograph, be careful not to immerse Pantograph in the kerosene and thus soak up the felt seals.

3. LOCATING THE MACHINE

All machines are completely assembled, ready for use, with exception of Pantograph, which is boxed separately. Before installing this, place the machine in desired location, close to a good window light if possible, opposite the center of window and *with the operator facing the window* (not the machine table). This is especially important if the machine is to be used for small delicate work, as daylight is always better than artificial light.

LEVELLING

Machine should then be levelled by means of a small machinist level placed on the machine table. While the base is drilled for lag screws, these are necessary only for shipping. It is important, however, that the machine be placed on as flat and solid a floor as possible.

5. SETTING THE SLIDER HEAD

With the wrench provided, loosen bolt "M" which clamps the Forming and Routing attachment to the Slider head. The front end can then be pushed down (or gently pried and tapped with wood block) releasing the hinged cutter head and link. This cutter head and link is also held in the shipping position when it is desired to operate machine as a vertical miller or router with a fixed spindle. Now, with bolt "M" loosened, move the Slider head to the position indicating on the graduated scale at right side of head, the scale of reduction to be used. Then clamp bolt "M" firmly. This setting of Slider head need only be approximate without affecting accuracy of the machine.

6. PUTTING THE PANTOGRAPH IN PLACE

Now, holding Pantograph in position shown below, place SLIDER BAR "F" in SLIDER BLOCK "H", with index spot to the front. Then insert SLIDER BAR "B" in SLIDER BLOCK "E" with index spot toward "S". Take care that edges of blocks and bars are not dented or battered 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 to the desired reduction and locking the bars in the blocks by means of the hexagon cap screws in each block, the machine is ready for use.

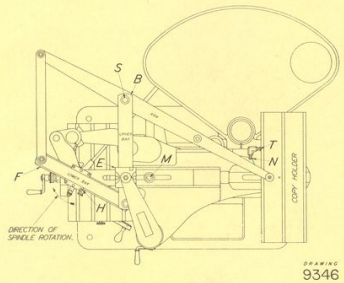


Fig. 2—Top View of Machine with Assembly Reference Points

Photo 5

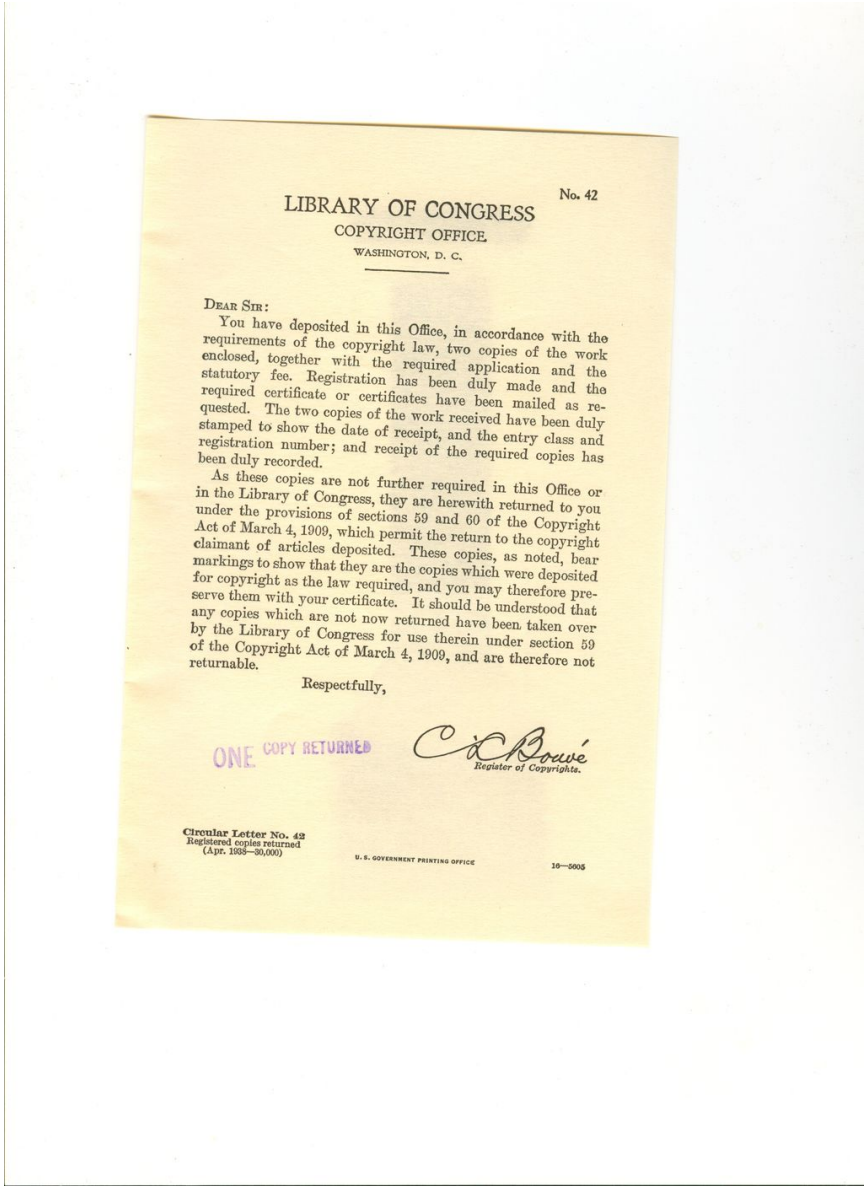


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Photo 6

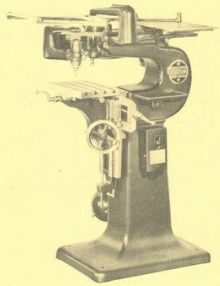
GORTON
RACINE, WIS., U.S.A.

LUBRICATION and ADJUSTMENT of 3-F, 3-U, (small size) MACHINES

UNPACKING and ERECTING
Same as page 3.

LUBRICATION
Correct grades of oils and greases:

Only pure neutral mineral oils and greases should be used. For lubricating the cutter spindle use preferably a *spindle oil* such as Gargoyle Oil Company's Velocite Oil "S" or equivalent, having a viscosity approximating 80 seconds at 100 degrees F. Do not use 3 in 1 and similar utility oils. These may gum the bearings. For all other oil holes and oil cups either a light or medium machine oil. For all grease cups use a light grease equivalent to Gargoyle BRB No. 1. For repacking Pantograph bearings use vaseline, or preferably Gargoyle BRB No. 1.



3-U Machine

Oil twice a day:
Cutter spindle, through oil hole "A" and "B", page 6. Guide pulley oil cups "C" and "D", page 5.

Oil once a week:
All other oil holes and oil cups. Run out work table to extreme positions and squirt a few drops of oil on table and saddle screws. Give drive pulley stud grease cup "E", page 5, one turn.

Once a month:
Lubricate motor oilers with a few drops of medium machine oil preferably Gargoyle Etna Oil Heavy. Be careful not to use too much oil.

Once a year:
Remove grease plugs "F" on cutter head link, page 5, and inserting a grease cup or gun, fill. Remove the polished dust washers 6943-A, page 5, covering Pantograph bearings, by inserting a thin bladed knife in the washer slot. Repack bearings with vaseline, packing it in tightly so as to force new supply into lower bearing. Snap washers back into place with fingers. Remove nuts 3336-A, page 6, which hold Pantograph link and repack these bearings. Remove cap 7110-A, page 5, and repack chamber with cup grease.

THE CUTTER SPINDLE
Spindle has non-adjustable bearings which automatically take up wear and require no attention except oiling. The spindle is quickly removable and should trouble of any kind develop, we suggest that it be returned to us for overhaul, which will be done promptly and at nominal cost as there is very little to wear on these spindles.

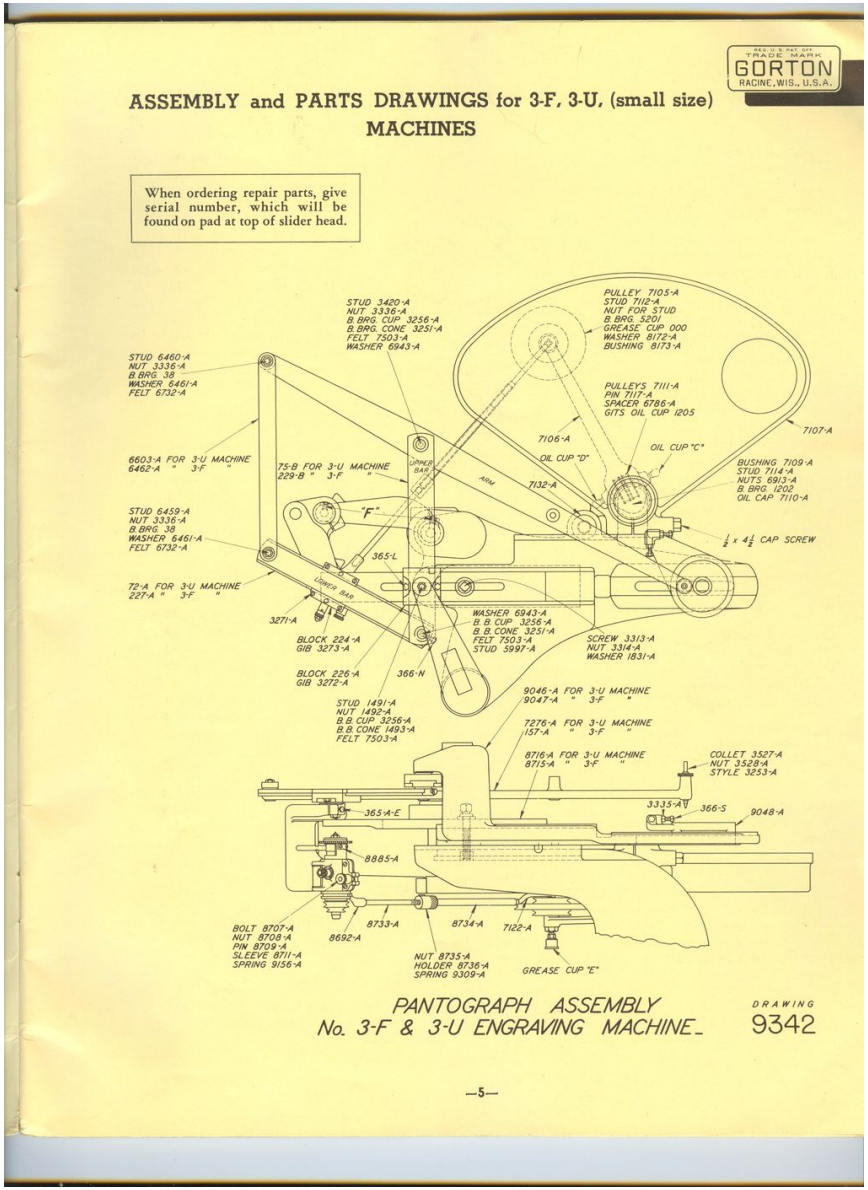
THE PANTOGRAPH
Pantograph needs no care except occasional greasing as above. Should play develop in the joints after several years' use, it can easily be removed by tightening nuts 3336-A on Pantograph studs 3263-A, page 6. These should be tightened very slightly, as too much will cause the balls to cut into the cups causing rapid wear and inaccuracy. Before tightening, loosen cap screw 365-A-E on cutter head, page 5, to allow Pantograph to realign itself properly. Then remove Pantograph entirely and test the Pantograph block 226-A attached to slider head and Block 224-A attached to cutter head, taking these up first. Then insert Pantograph in slider head block only, with cutter head swung out of the way, and test Pantograph bearings.

THE CUTTER HEAD LINK
Cutter head link bearings should not require attention other than greasing. If, after several years, these become a trifle loose, they can be taken up by loosening slightly (not entirely) the Bristo cap screw "G", page 6, and tapping downward against top of the plug 8713-A or 8714-A.

GENERAL CARE
The machines should be thoroughly cleaned at least once a week and the scraped ways wiped clean and oiled.

Mechanical specifications and complete description in Booklet 1321. Areas covered at one setting shown actual size at rear of this book. Accessories for use with these machines in Accessories catalog 1317. Copy for use with these machines in Copy catalog 1309.

Photo 7



GORTON
TRADE MARK
RACINE, WIS., U.S.A.

ASSEMBLY and PARTS DRAWINGS for 3-F, 3-U, (small size) MACHINES

When ordering repair parts, give serial number, which will be found on pad at top of slider head.

PANTOGRAPH ASSEMBLY
No. 3-F & 3-U ENGRAVING MACHINE

DRAWING
9342

Photo 8

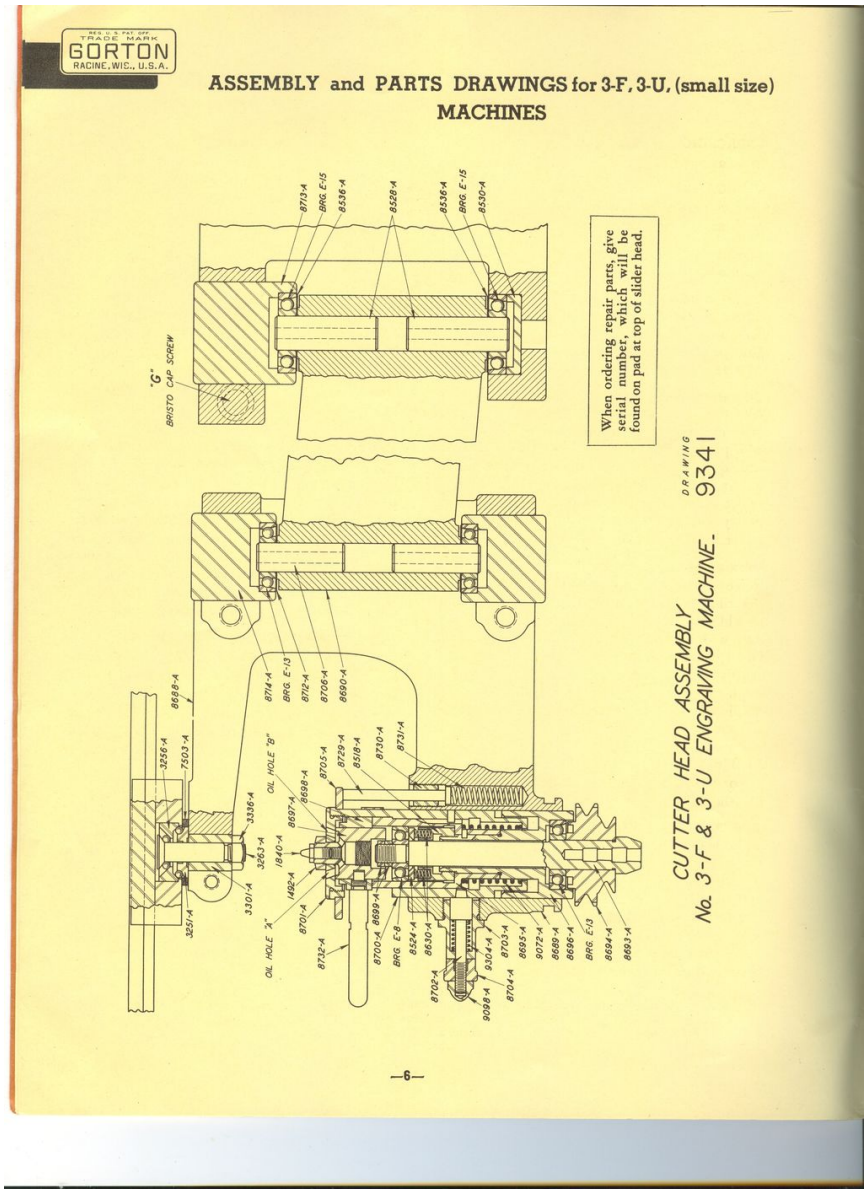

GORTON
RACINE, WIS., U.S.A.
ASSEMBLY and PARTS DRAWINGS for 3-F, 3-U, (small size)
MACHINES
When ordering repair parts, give serial number, which will be found on pad at top of slider head.
CUTTER HEAD ASSEMBLY
No. 3-F & 3-U ENGRAVING MACHINE.
DRAWING 9341
—6—

Photo 9

GORTON
RACINE, WIS., U.S.A.

LUBRICATION and ADJUSTMENT of 3-X, 3-Z, (medium size) MACHINES

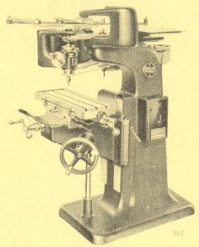
UNPACKING and ERECTING
Same as page 3.

LUBRICATION
Correct grades of oils and greases:

Same as page 4, for 3-F, 3-U machines.

Oil twice a day:
Cutter spindle, through holes "C" and "D", page 9. Oil cup, 301, page 9. Guide pulley oil cups 1205, page 8.

Oil once a week:
All other oil holes and oil cups. (Do not forget to replace oil hole plugs). Run out table to extreme positions and squirt a few drops of oil on table and saddle screws. Lift the knee elevating screw cover and squirt a few drops of oil on screw. Give drive pulley stud grease cup 000, page 8, one turn, also cutter head link grease cups 00, page 8.



3-Z Machine

Once a year:
Remove the polished dust washers 6795-A, page 8, covering the Pantograph bearings, by inserting a thin bladed knife in the washer slot. Repack bearings with vaseline, or preferably Gargoyle BRB No. 1, packing it in tightly so as to force a new supply into lower bearing. Snap washers back into place with fingers. Remove nuts 6208-A, page 8, holding Pantograph link. Repack these bearings as above. Remove cap 7110-A, page 8, and repack chamber with cup grease equivalent to Gargoyle BRB No. 1. Inspect the ball bearing grease packed motor journals and repack if necessary, although this should only be required once every two years.

THE CUTTER SPINDLE
Spindle has no adjustable bearings and requires no attention except oiling. If, after several years of use, the spindle becomes inaccurate through ball bearing wear, new ones can be inserted at low cost which will make the spindle as accurate as new. Care should be taken not to use cutters more than one or two thousandths undersize. Smaller ones require the collet nut to be pulled up very tight to prevent cutter slippage and may permanently spring the spindle, causing cutters to run out of true.

On machines equipped with removable spindle 698-1 the same instructions apply as above, with this addition: When spindle is removed from machine, care should be taken to prevent small chips and grinding dust from lodging around top seal. Always clean outside of spindle thoroughly before inserting in machine.

THE PANTOGRAPH
Pantograph needs no care except occasional greasing as above. Should play develop in the joints after several years of use, it can easily be removed by tightening nuts 6913-A on Pantograph studs 6184-B, 6185-B, pages 8 and 9. These should be tightened very slightly, as too much will cause the balls to cut a groove in the cups causing inaccuracy and rapid wear. Before tightening, loosen hex. cap screw "E" on cutter head (page 8) to allow Pantograph to realign itself properly.

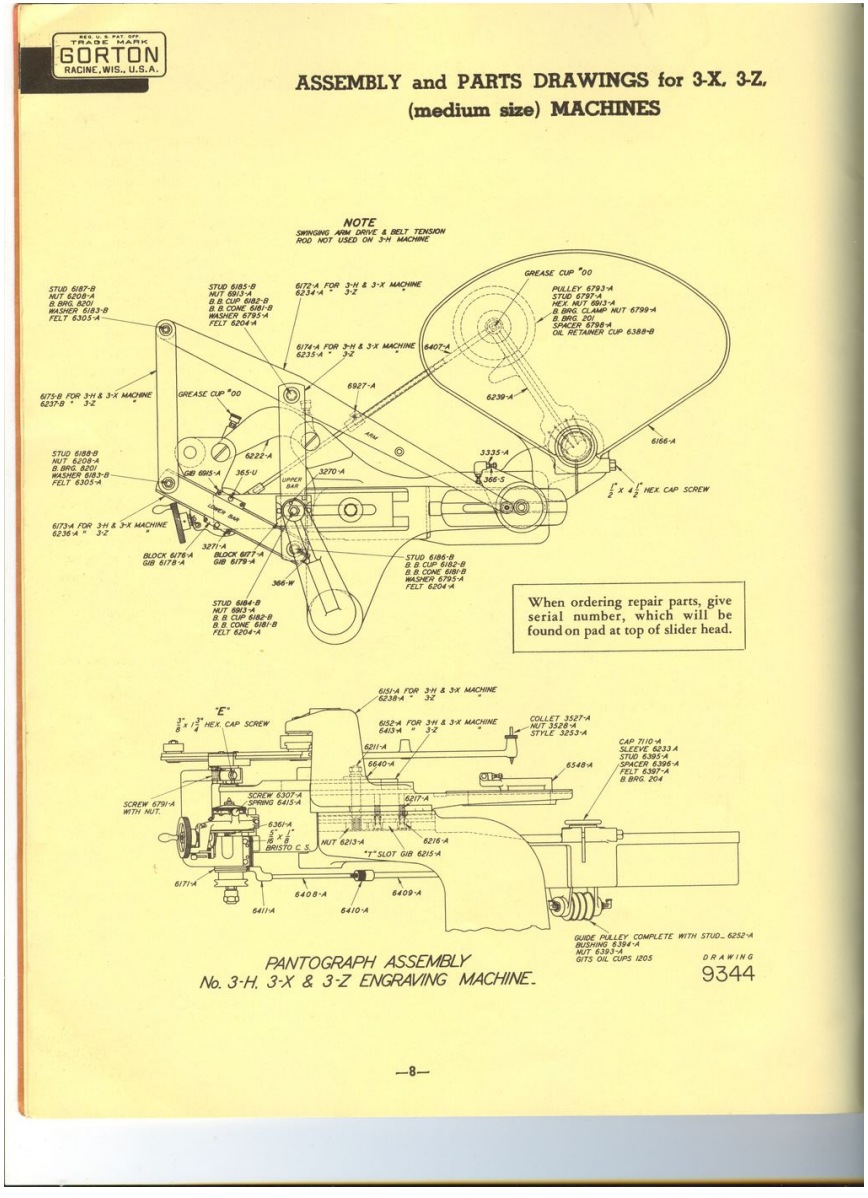
THE CUTTER HEAD LINK
Cutter head link bearings should require no attention except greasing. If, after several years of use, they become loose, they can easily be taken up by loosening the Bristo set screws "F" at top, page 9, and tightening slotted head adjusting screws 6359-A. This should rarely if ever be necessary.

TABLE GIBS
Table gibs are tapered with adjusting screw at one end of gib and locking screw at other end. To tighten gib, loosen locking screw at small end of gib, tightening the screw at opposite end as required. Knee gib has a tapered side and a glance will show how to take it up.

GENERAL CARE
The machine should be thoroughly cleaned at least once a week and the scraped ways wiped clean and oiled.

Mechanical specifications and complete description in Booklet 1321. Areas covered at one setting shown actual size at back of this book. Accessories for use with these machines in Accessories catalog 1317. Copy for use with these machines in Copy catalog 1309.

Photo 10



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RACINE, WIS., U.S.A.

ASSEMBLY and PARTS DRAWINGS for 3-X, 3-Z, (medium size) MACHINES

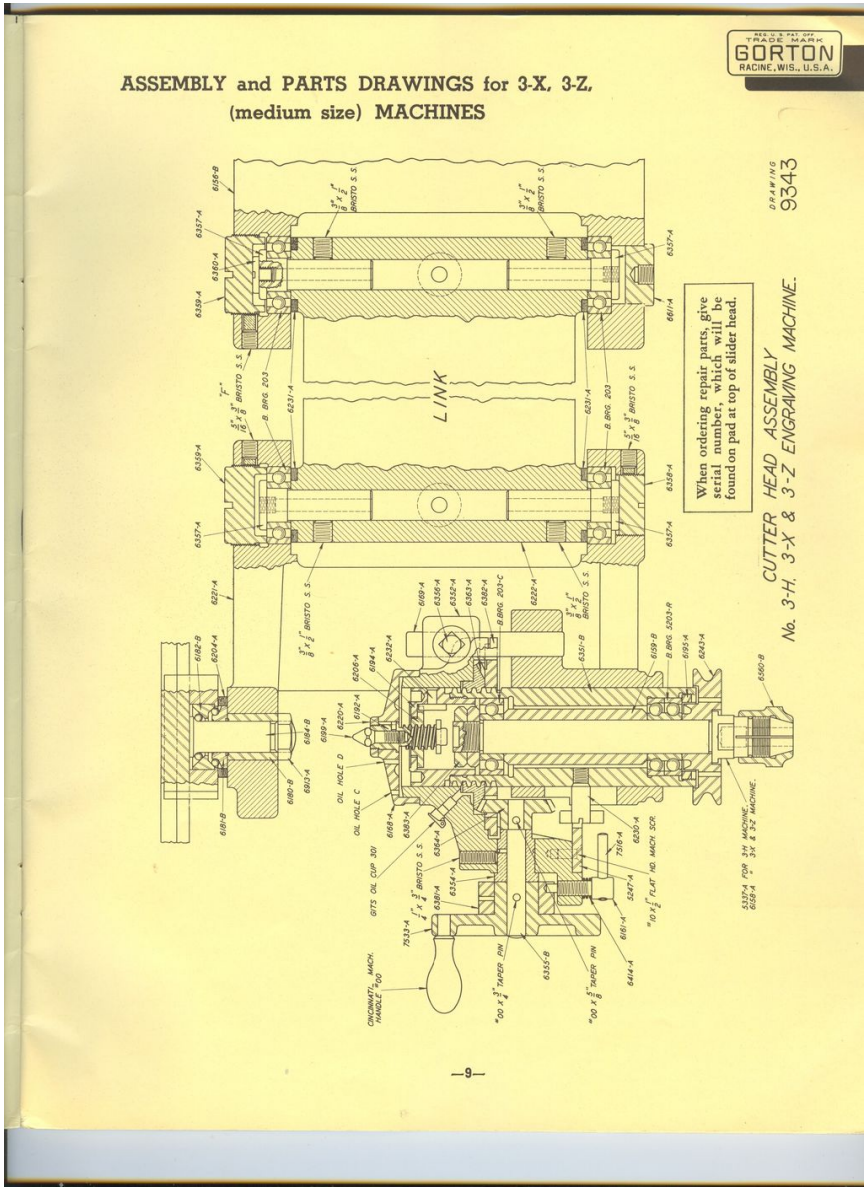
NOTE
SWINGING ARM DRIVE & BELT TENSION ROD NOT USED ON 3-H MACHINE

When ordering repair parts, give serial number, which will be found on pad at top of slider head.

PANTOGRAPH ASSEMBLY
No. 3-H, 3-X & 3-Z ENGRAVING MACHINE.

DRAWING 9344

Photo 11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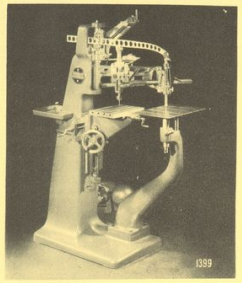
TRADE MARK
GORTON
RACINE, WIS., U.S.A.
ASSEMBLY and PARTS DRAWINGS for 3-X, 3-Z,
(medium size) MACHINES
DRAWING
9343
CUTTER HEAD ASSEMBLY
No. 3-H, 3-X & 3-Z ENGRAVING MACHINE.
When ordering repair parts, give serial number, which will be found on pad at top of slider head.
LINK
—9—

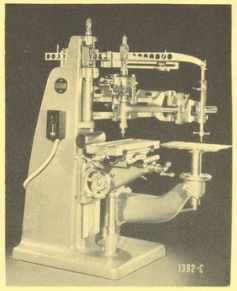
Photo 12

GORTON
RACINE, WIS., U.S.A.

LUBRICATION and ADJUSTMENT of 3-B, 3-L (3-Dimensional) MACHINES



3-B Machine



3-L Machine

UNPACKING and ERECTING

Same as paragraphs 1, 2, 3, 4, 5, page 3. 3-B and 3-L machines are shipped with Pantograph completely assembled. A special casting fitting around the cutter spindle and bolted to machine table, secures Pantograph during shipment. Loosen the bolts holding this casting and remove. The machine is then ready to operate, after slipping on the motor drive and cutter spindle belts.

LUBRICATION

Correct grades of oils and greases:
Same as page 4, for 3-F, 3-U machines, except Gargoyle BRB No. 1 grease is used in Pantograph bearings also, and in ball bearing motor. Use Gargoyle Etna Oil Heavy for plain bearing motors.

Oil twice a day:

Cutter spindle, through hinge lid oil cup at top of spindle (not shown on page 11), "A" page 13.

Oil once a week:

All other oil holes and oil cups. Run out work table to extreme positions and squirt a few drops of oil on table and saddle screws. Give all grease cups one turn. Lift the knee elevating screw cover and squirt a few drops of oil on screw, (not covered on 3-B). Wipe all polished Pantograph surfaces with oily rag to prevent rust.

Once a year:

Remove cap corresponding to 7110-A, page 8, covering idler pulley pivot stud and repack chamber with grease. If ball bearing motor, inspect and add grease if necessary.

Once every two years:

Remove the ⅛″ slotted pipe plugs at top and bottom of every Pantograph pivot joint, and by inserting grease cup, grease gun, or Alemite fitting and gun, fill with new grease until the old oozes out around sides of seals, using Gargoyle BRB No. 1. Be very careful not to use a stiffer grease than this.

THE CUTTER SPINDLE

Cutter spindle has no adjustable bearings and requires no attention except oiling. If, after several years of use, the spindle becomes inaccurate through wear of the ball bearings, new ones can be inserted at low cost which will make the spindle as accurate as new. Care should be taken not to use cutters more than one or two thousandths undersize, as smaller ones require the collet nut to be pulled up very tight to prevent cutter slippage and may permanently spring the spindle, causing cutters to run out of true.

3-I spindle is removable by turning to right and unscrewing. When spindle is removed from machine care should be taken to prevent small chips and grinding dust lodging around top seal. Always clean outside of spindle thoroughly before inserting in machine.

TABLE GIBS

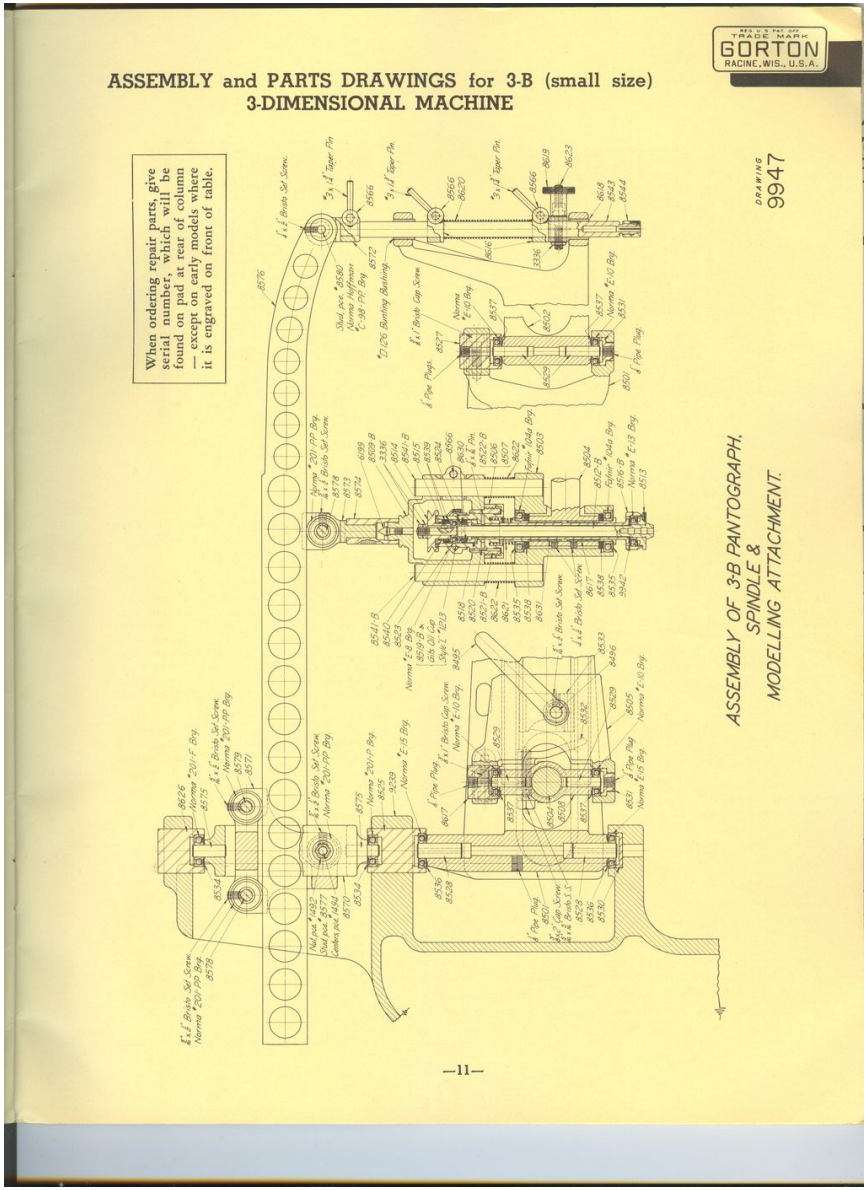
3-L table gibs are tapered with adjusting screw at one end of gib and locking screw at other end. To tighten gib, loosen locking screw at small end of gib, tightening the screw at opposite end as required. Knee gib has tapered side and a glance will show how to take it up.

GENERAL CARE

The machine should be throughly cleaned at least once a week and the scraped ways wiped clean and oiled.

Mechanical specifications and complete description in Booklet 1322-A. Areas covered at one setting shown half size at back of this book. Reduction formula and schedules on page 40. Accessories for use with these machines in Accessories catalog 1317. Copy for use with these machines in Copy catalog 1309.

Photo 13



ASSEMBLY and PARTS DRAWINGS for 3-B (small size)
3-DIMENSIONAL MACHINE

GORTON
RACINE, WIS., U.S.A.

When ordering repair parts, give serial number, which will be found on pad at rear of column — except on early models where it is engraved on front of table.

DRAWING 9947

ASSEMBLY OF 3-B PANTOGRAPH, SPINDLE & MODELLING ATTACHMENT.

Photo 14

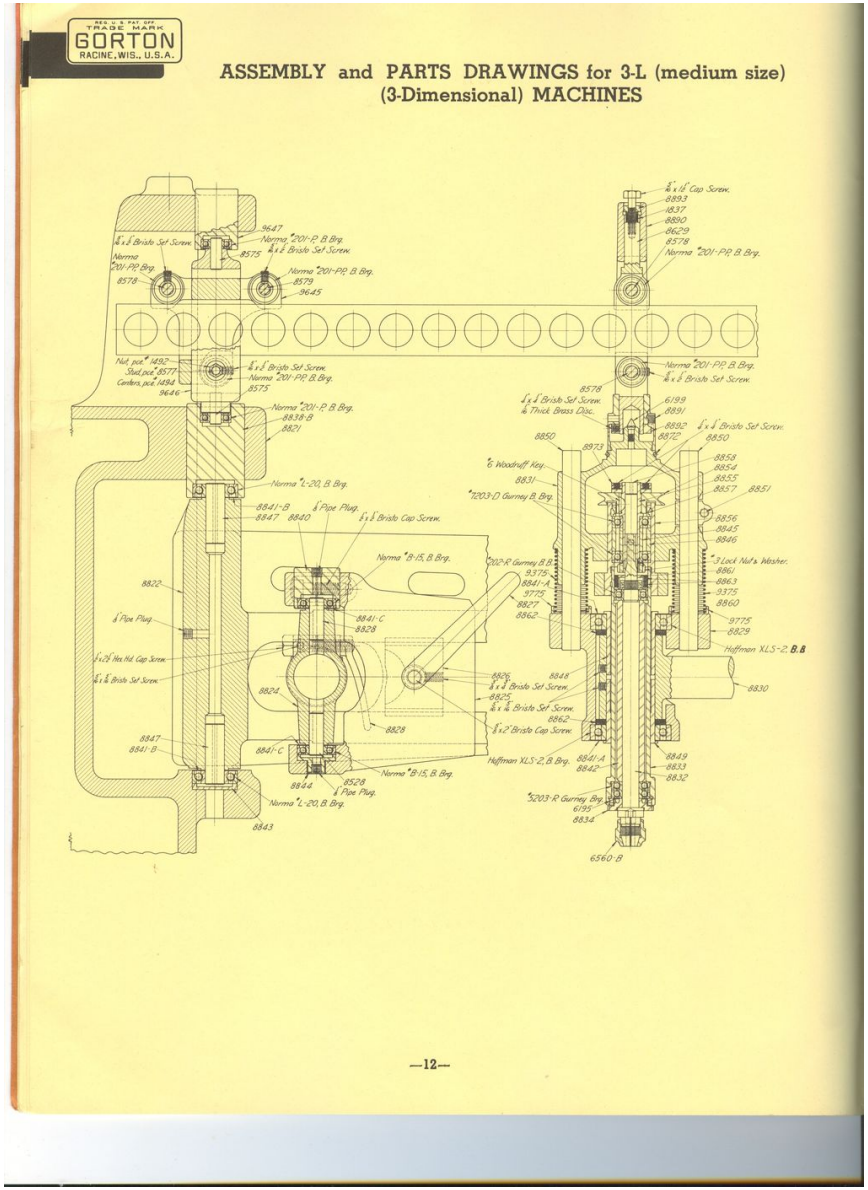
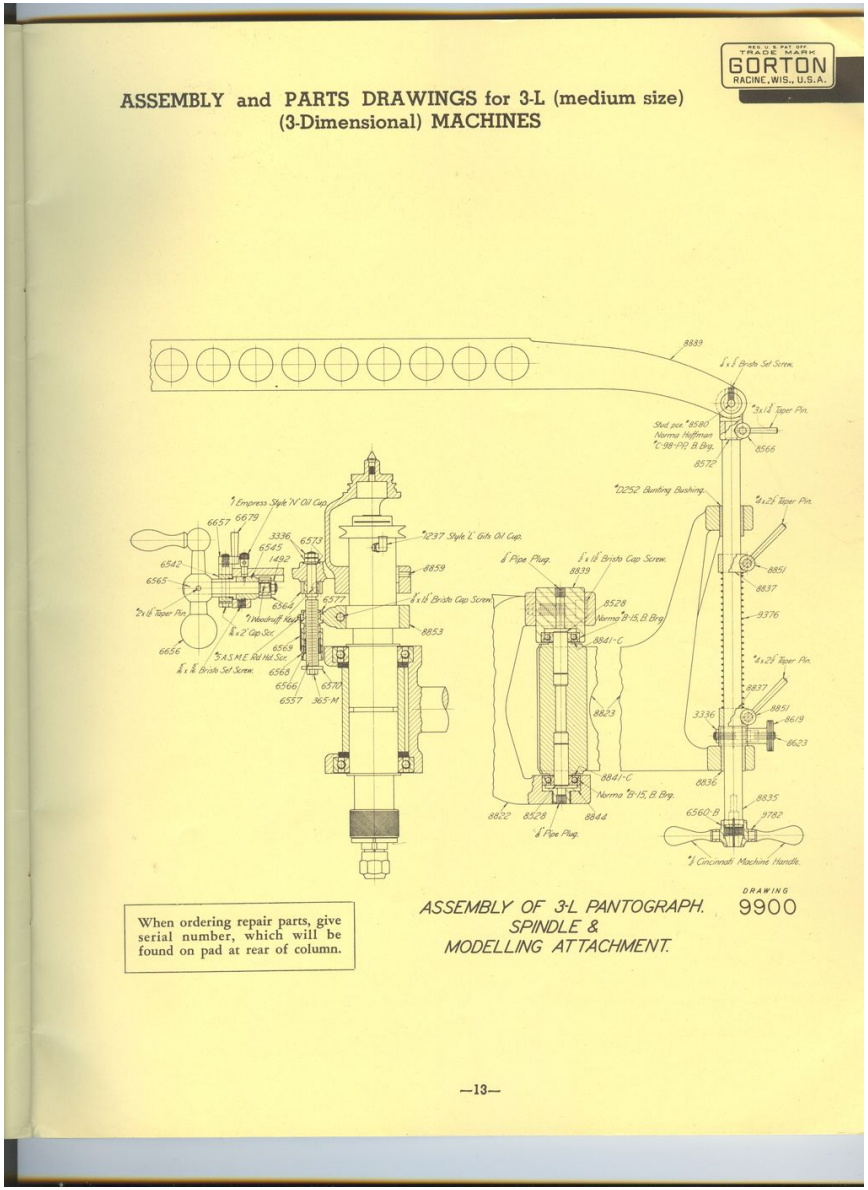

GORTON
RACINE, WIS., U.S.A.
ASSEMBLY and PARTS DRAWINGS for 3-L (medium size)
(3-Dimensional) MACHINES
—12—

Photo 15



GORTON
RACINE, WIS., U.S.A.

ASSEMBLY and PARTS DRAWINGS for 3-L (medium size)
(3-Dimensional) MACHINES

When ordering repair parts, give serial number, which will be found on pad at rear of column.

ASSEMBLY OF 3-L PANTOGRAPH. SPINDLE & MODELLING ATTACHMENT.

DRAWING 9900

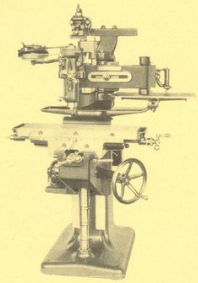
Photo 16

GORTON
RACINE, WIS., U.S.A.

LUBRICATION and ADJUSTMENT of *3-S (large size) MACHINE

UNPACKING and ERECTING

Same as paragraphs 1, 2, 3, 4, 5, page 3. 3-S machines are shipped with Pantograph completely assembled, except on machines for export, when the Pantograph is disassembled and boxed separately. For all domestic shipments, a special casting is made, fitting around cutter spindle and clamped to table of machine. Loosen the bolts holding this casting and remove. The machine is then ready to operate.



3-S Machine

LUBRICATION

Correct grades of oils and greases:

Same as page 4, for 3-F, 3-U machines, except Gargoyle BRB No. 1 grease is used exclusively in Pantograph bearings also.

Oil twice a day:

Cutter spindle, through oil cup "A", page 16. Cutter spindle drive pulley 6536-A, page 16, through oil hole "B".

Oil once a week:

All other oil holes and oil cups. Run out table to extreme positions and squirt a few drops of oil on table and saddle screws. Lift the knee elevating screw cover and squirt a few drops of oil on screw. Give all grease cups one turn and Alemite fittings one shot, except Pantograph bearings, which are only necessary to lubricate twice a year. *Once a year:* The cap 7110-A, page 11, should be removed and chamber repacked with grease. Inspect the ball bearing motor and add grease (BRB No. 1) if necessary.

THE CUTTER SPINDLE

Cutter spindle has no adjustable bearings and requires no attention except oiling. If, after several years of use, the spindle becomes inaccurate through wear of the ball bearings, new ones can be inserted at low cost which will make the spindle as accurate as new. Care should be taken not to use cutters more than one or two thousandths undersize, as smaller ones require the collet nut to be pulled up very tight to prevent cutter slippage and may permanently spring the spindle, causing cutters to run out of true.

TABLE GIBS

Table gibs are tapered with adjusting screw at one end of gib and locking screw at opposite end. To tighten gib, loosen locking screw at small end of gib, tightening the screw at opposite end as required. Knee gib has a tapered side and a glance will show how to take it up.

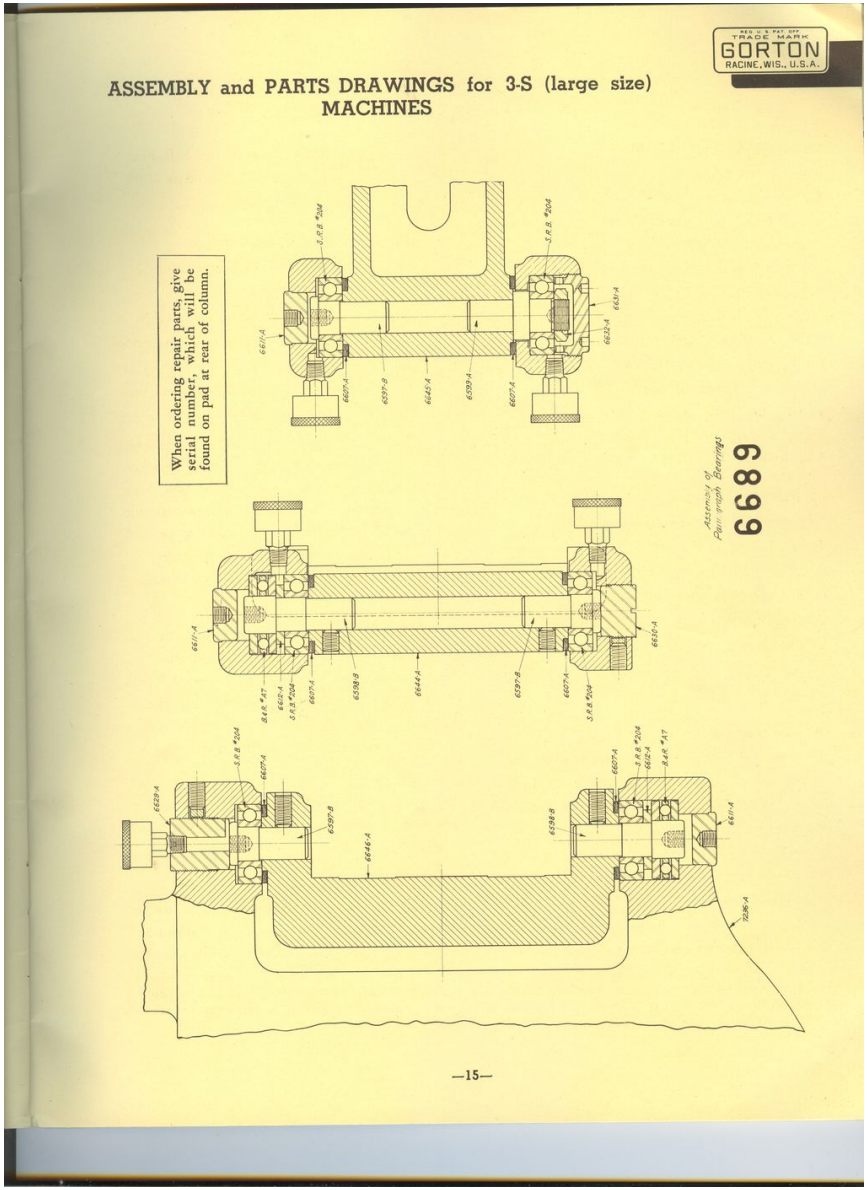
GENERAL CARE

The machine should be thoroughly cleaned at least once a week and the scraped ways wiped clean and oiled.

*NOTE: All instructions on this page also apply to model 1-S machines, now obsolete. The improvement in design has not altered construction or operation of any essential parts of the machine.

Mechanical specifications and complete description in Booklet 1226. Areas covered at one setting shown actual size in rear of book. Accessories for use with these machines in Accessories catalog 1317. Copy for use with these machines in Copy catalog 1309.

Photo 17



ASSEMBLY and PARTS DRAWINGS for 3-S (large size) MACHINES

GORTON
RACINE, WIS., U.S.A.

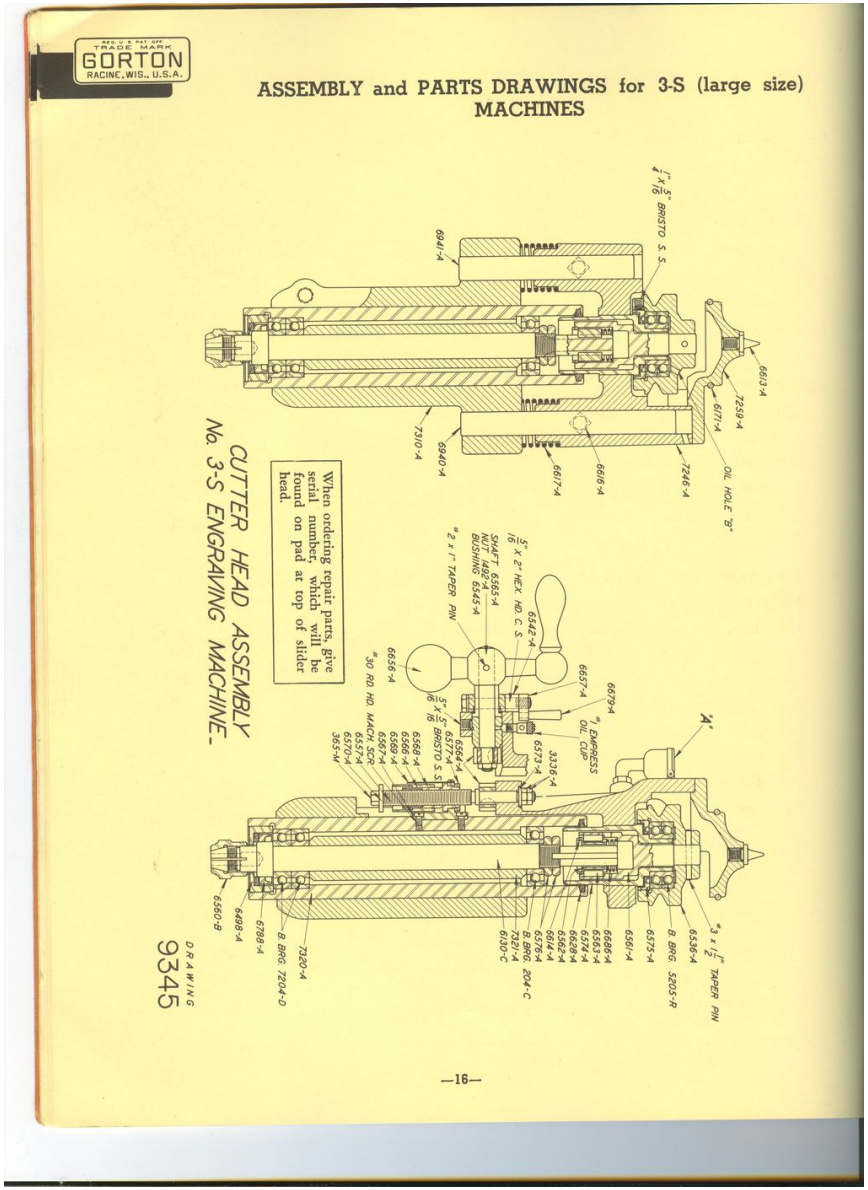
When ordering repair parts, give serial number, which will be found on pad at rear of column.

6689

Assembly of Pan (main) Bearings

—15—

Photo 18



GORTON
RACINE, WIS., U.S.A.

ASSEMBLY and PARTS DRAWINGS for 3-S (large size) MACHINES

CUTTER HEAD ASSEMBLY
No. 3-S ENGRAVING MACHINE.

When ordering repair parts, give serial number, which will be found on pad at top of slider head.

DRAWING
9345

Photo 19

GORTON
RACINE, WIS., U.S.A.

LUBRICATION and ADJUSTMENT of 3-K, 3-R, 1-H, 3-H MACHINES

UNPACKING and ERECTING

Same as page 3 for all models above.

LUBRICATION

The correct grades of oils and greases for all of the above models are the same as given on page 4. Follow the oiling instructions given on page 7 for models 3-K, 3-R and 3-H, and on page 4 for model 1-H.

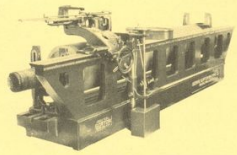
ADJUSTMENT

The 3-K, 3-R and 3-H models are adjusted as described on page 7, except all 3-K machines are equipped with removable cutter spindles. Instructions for adjusting 3-K cutter head links are the same as for 3-F, 3-U machines on page 4. Model 1-H is adjusted as described on page 4.

IMPORTANT 3-K INSTRUCTIONS

Before attempting to adjust or disassemble the ball bearing cutter head auxiliary support, as shown in drawing 7554-B on page 8 of booklet 1242, send to factory for complete assembly drawings of these parts and instructions. This entire assembly must be in perfect alignment to insure smooth and accurate operation, and it can easily be thrown out of adjustment or damaged by incorrect adjustment. For additional instructions on these machines consult the following specification booklets:

3-K	see Booklet 1242
3-R	see Booklet 1256
3-H	see Booklet 1060
1-H	see Booklet 1057



3-R—No. 1250-R

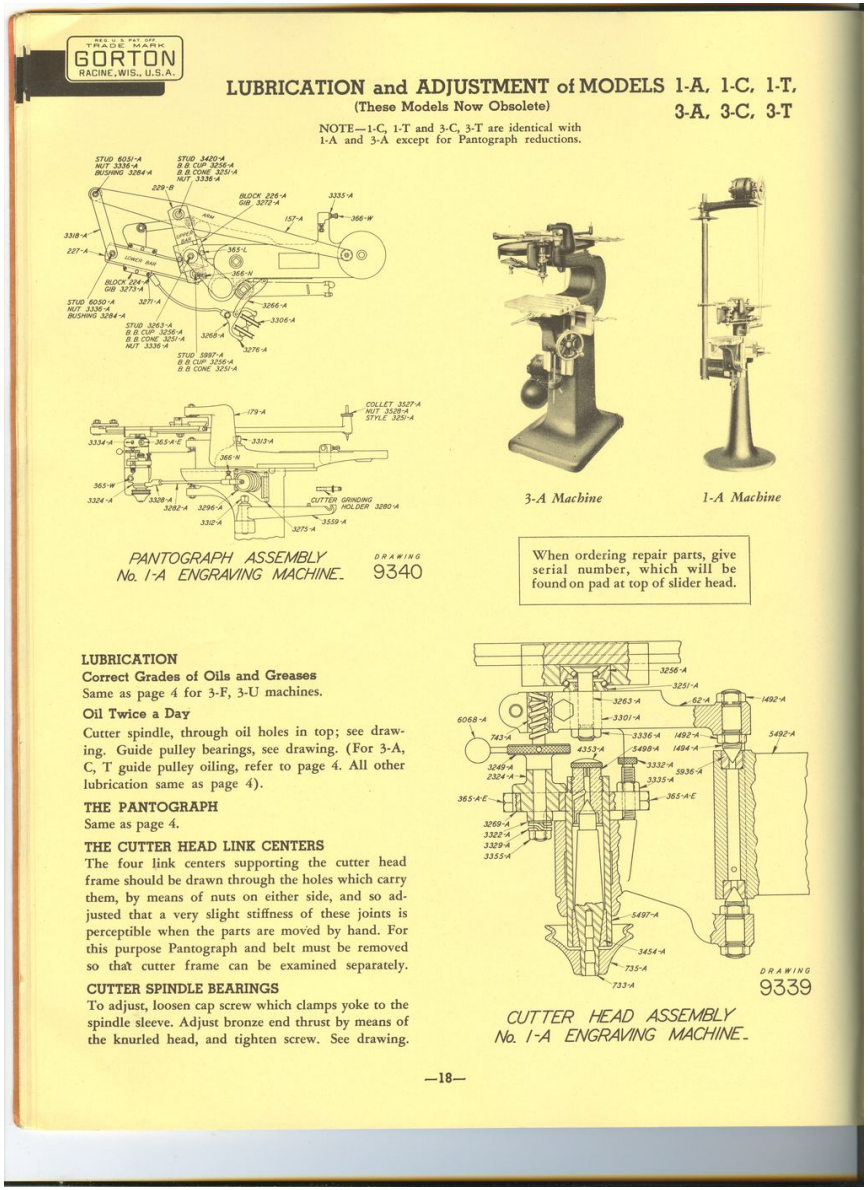
1-H—No. 1081

3-H—No. 1175-B

3-K—No. 1255

Accessories for use with these machines in Accessories catalog 1317. Copy for use with these machines in Copy catalog 1309.

Photo 20



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LUBRICATION and ADJUSTMENT of MODELS 1-A, 1-C, 1-T, 3-A, 3-C, 3-T

(These Models Now Obsolete)

NOTE—1-C, 1-T and 3-C, 3-T are identical with 1-A and 3-A except for Pantograph reductions.

PANTOGRAPH ASSEMBLY
No. 1-A ENGRAVING MACHINE.

DRAWING 9340

3-A Machine

1-A Machine

When ordering repair parts, give serial number, which will be found on pad at top of slider head.

LUBRICATION

Correct Grades of Oils and Greases

Same as page 4 for 3-F, 3-U machines.

Oil Twice a Day

Cutter spindle, through oil holes in top; see drawing. Guide pulley bearings, see drawing. (For 3-A, C, T guide pulley oiling, refer to page 4. All other lubrication same as page 4).

THE PANTOGRAPH

Same as page 4.

THE CUTTER HEAD LINK CENTERS

The four link centers supporting the cutter head frame should be drawn through the holes which carry them, by means of nuts on either side, and so adjusted that a very slight stiffness of these joints is perceptible when the parts are moved by hand. For this purpose Pantograph and belt must be removed so that cutter frame can be examined separately.

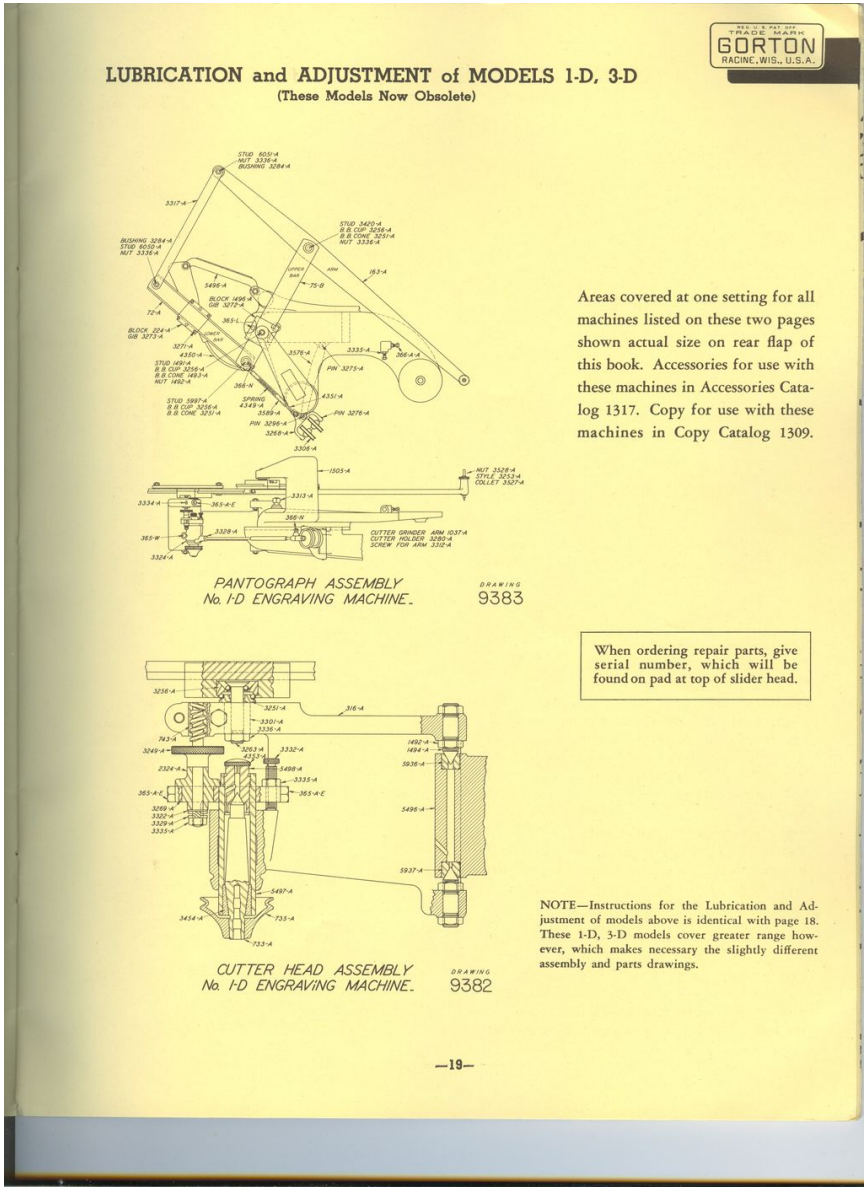
CUTTER SPINDLE BEARINGS

To adjust, loosen cap screw which clamps yoke to the spindle sleeve. Adjust bronze end thrust by means of the knurled head, and tighten screw. See drawing.

DRAWING 9339

CUTTER HEAD ASSEMBLY
No. 1-A ENGRAVING MACHINE.

Photo 21



GORTON
RACINE, WIS., U.S.A.

LUBRICATION and ADJUSTMENT of MODELS 1-D, 3-D

(These Models Now Obsolete)

PANTOGRAPH ASSEMBLY
No. 1-D ENGRAVING MACHINE. DRAWING 9383

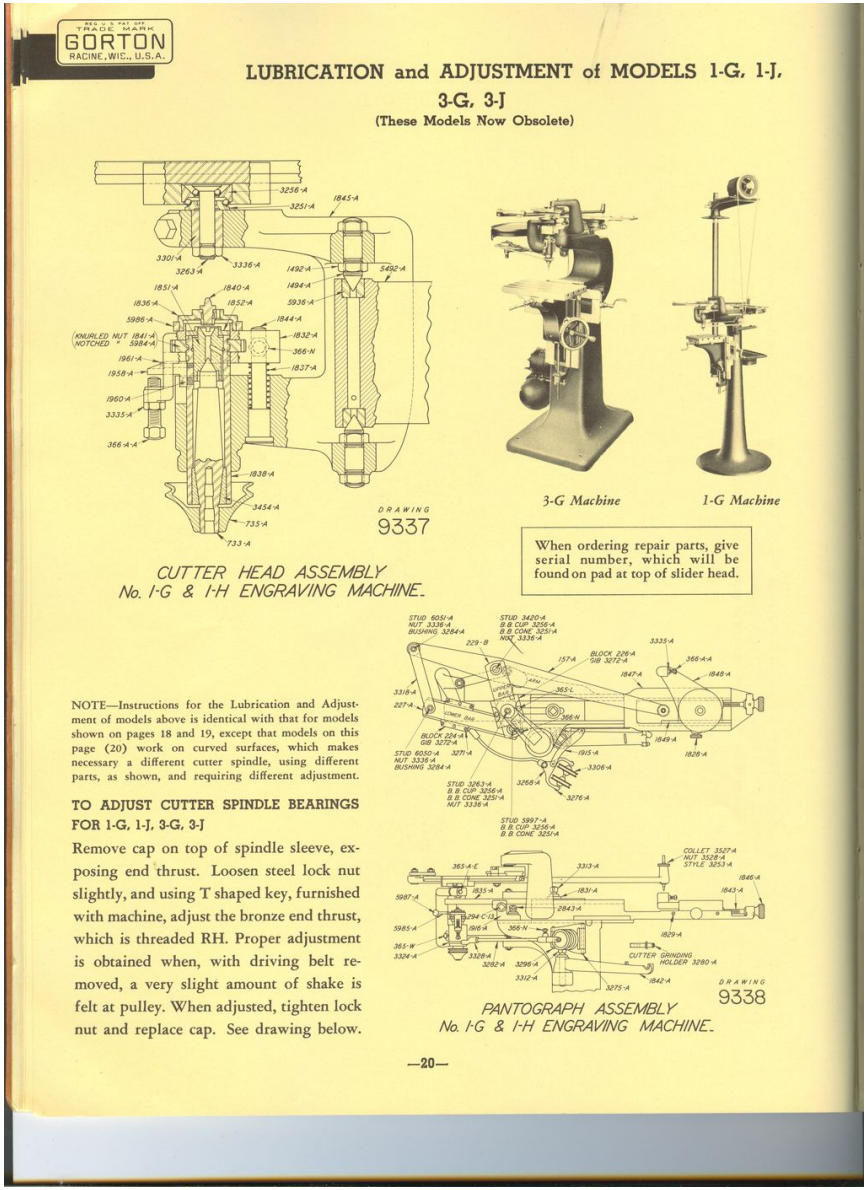
Areas covered at one setting for all machines listed on these two pages shown actual size on rear flap of this book. Accessories for use with these machines in Accessories Catalog 1317. Copy for use with these machines in Copy Catalog 1309.

When ordering repair parts, give serial number, which will be found on pad at top of slider head.

CUTTER HEAD ASSEMBLY
No. 1-D ENGRAVING MACHINE. DRAWING 9382

NOTE—Instructions for the Lubrication and Adjustment of models above is identical with page 18. These 1-D, 3-D models cover greater range however, which makes necessary the slightly different assembly and parts drawings.

Photo 22



GORTON
RACINE, WIC., U.S.A.

LUBRICATION and ADJUSTMENT of MODELS 1-G, 1-J, 3-G, 3-J

(These Models Now Obsolete)

DRAWING 9337

CUTTER HEAD ASSEMBLY
No. 1-G & 1-H ENGRAVING MACHINE.

3-G Machine

1-G Machine

When ordering repair parts, give serial number, which will be found on pad at top of slider head.

NOTE—Instructions for the Lubrication and Adjustment of models above is identical with that for models shown on pages 18 and 19, except that models on this page (20) work on curved surfaces, which makes necessary a different cutter spindle, using different parts, as shown, and requiring different adjustment.

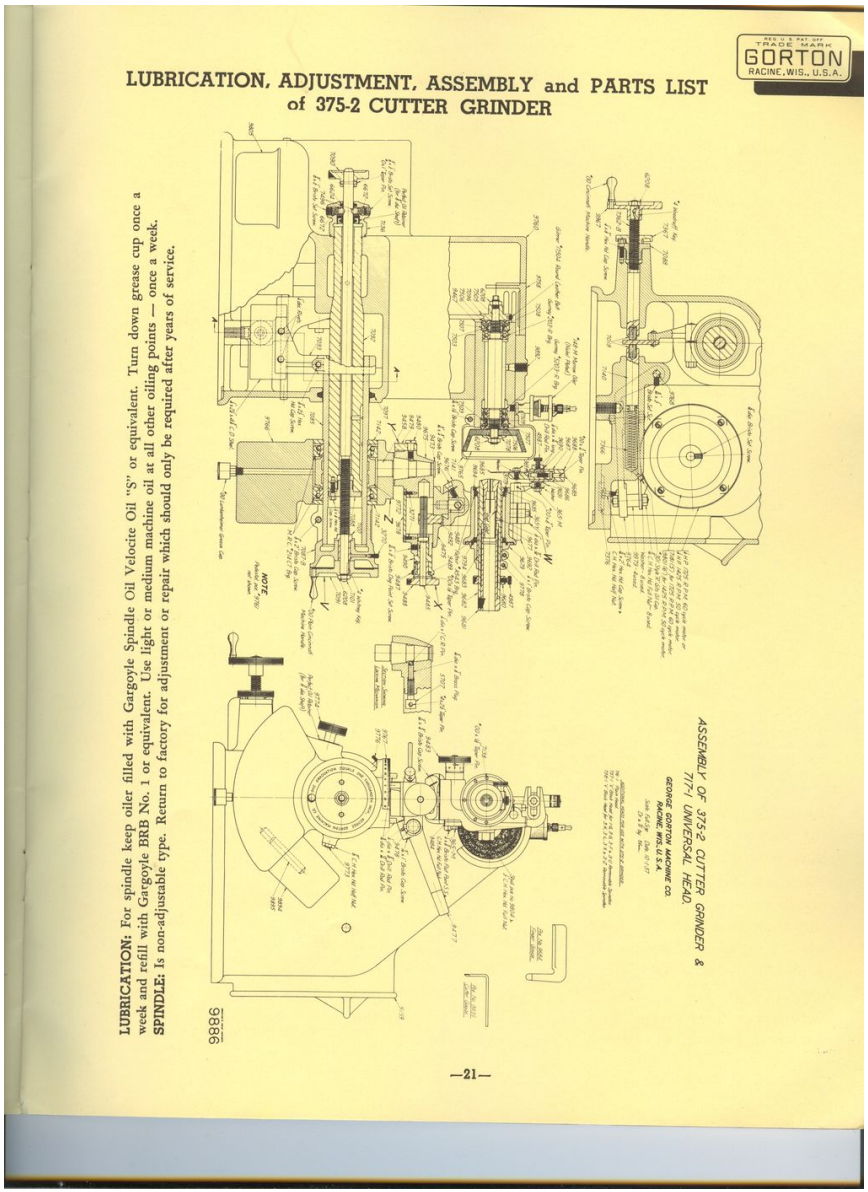
TO ADJUST CUTTER SPINDLE BEARINGS FOR 1-G, 1-J, 3-G, 3-J

Remove cap on top of spindle sleeve, exposing end thrust. Loosen steel lock nut slightly, and using T shaped key, furnished with machine, adjust the bronze end thrust, which is threaded RH. Proper adjustment is obtained when, with driving belt removed, a very slight amount of shake is felt at pulley. When adjusted, tighten lock nut and replace cap. See drawing below.

DRAWING 9338

PANTOGRAPH ASSEMBLY
No. 1-G & 1-H ENGRAVING MACHINE.

Photo 23



LUBRICATION, ADJUSTMENT, ASSEMBLY and PARTS LIST
of 375-2 CUTTER GRINDER

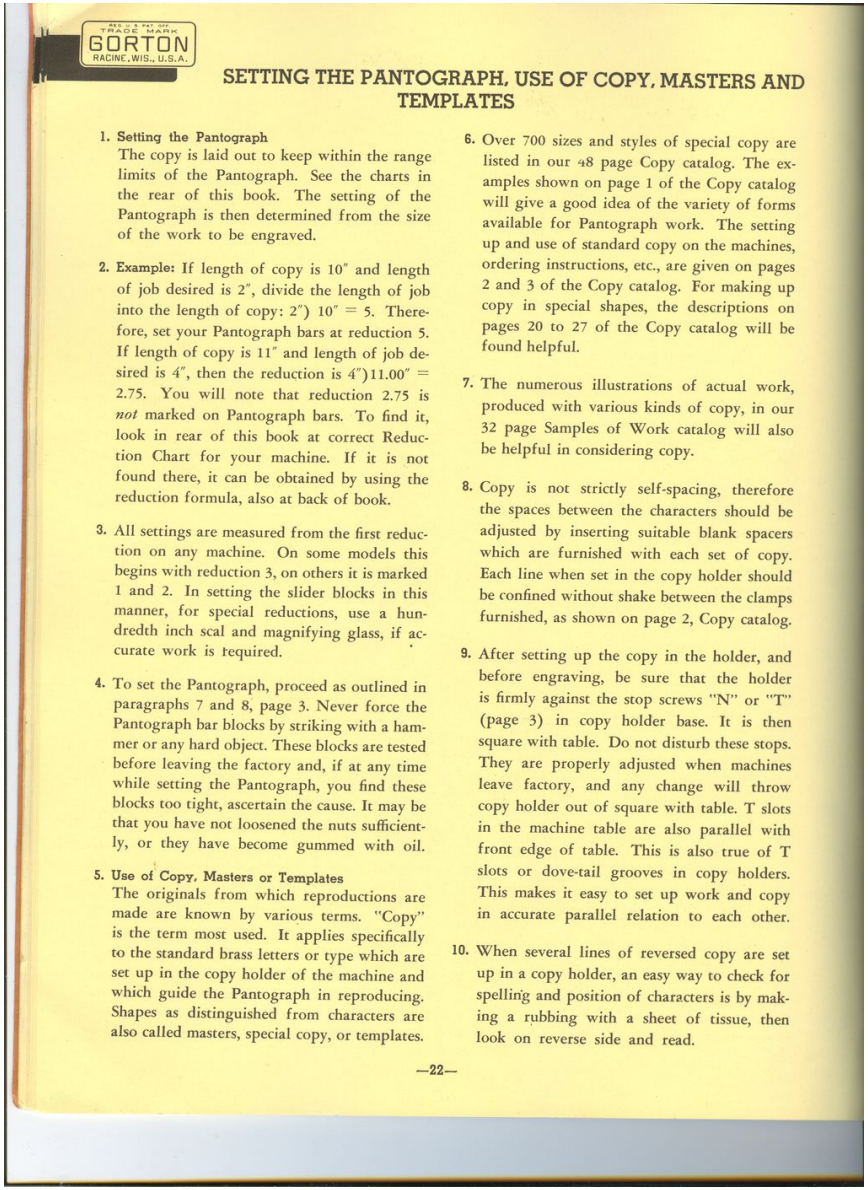
GORTON
RACINE, WIS., U.S.A.

LUBRICATION: For spindle keep oiler filled with Gargoyle Spindle Oil Velocite Oil "S" or equivalent. Turn down grease cup once a week and refill with Gargoyle BRB No. 1 or equivalent. Use light or medium machine oil at all other oiling points — once a week.
SPINDLE: Is non-adjustable type. Return to factory for adjustment or repair which should only be required after years of service.

ASSEMBLY OF 375-2 CUTTER GRINDER & 771-1 UNIVERSAL HEAD.
GEORGE GORTON MACHINE CO.
RACINE, WIS. U.S.A.

9886

Photo 24



GORTON
RACINE, WIS., U.S.A.

SETTING THE PANTOGRAPH, USE OF COPY, MASTERS AND TEMPLATES

1. **Setting the Pantograph**
The copy is laid out to keep within the range limits of the Pantograph. See the charts in the rear of this book. The setting of the Pantograph is then determined from the size of the work to be engraved.

2. **Example:** If length of copy is 10″ and length of job desired is 2″, divide the length of job into the length of copy: 2″) 10″ = 5. Therefore, set your Pantograph bars at reduction 5. If length of copy is 11″ and length of job desired is 4″, then the reduction is 4″)11.00″ = 2.75. You will note that reduction 2.75 is *not* marked on Pantograph bars. To find it, look in rear of this book at correct Reduction Chart for your machine. If it is not found there, it can be obtained by using the reduction formula, also at back of book.

3. All settings are measured from the first reduction on any machine. On some models this begins with reduction 3, on others it is marked 1 and 2. In setting the slider blocks in this manner, for special reductions, use a hundredth inch scal and magnifying glass, if accurate work is required.

4. To set the Pantograph, proceed as outlined in paragraphs 7 and 8, page 3. Never force the Pantograph bar blocks by striking with a hammer or any hard object. These blocks are tested before leaving the factory and, if at any time while setting the Pantograph, you find these blocks too tight, ascertain the cause. It may be that you have not loosened the nuts sufficiently, or they have become gummed with oil.

5. **Use of Copy, Masters or Templates**
The originals from which reproductions are made are known by various terms. "Copy" is the term most used. It applies specifically to the standard brass letters or type which are set up in the copy holder of the machine and which guide the Pantograph in reproducing. Shapes as distinguished from characters are also called masters, special copy, or templates.

6. Over 700 sizes and styles of special copy are listed in our 48 page Copy catalog. The examples shown on page 1 of the Copy catalog will give a good idea of the variety of forms available for Pantograph work. The setting up and use of standard copy on the machines, ordering instructions, etc., are given on pages 2 and 3 of the Copy catalog. For making up copy in special shapes, the descriptions on pages 20 to 27 of the Copy catalog will be found helpful.

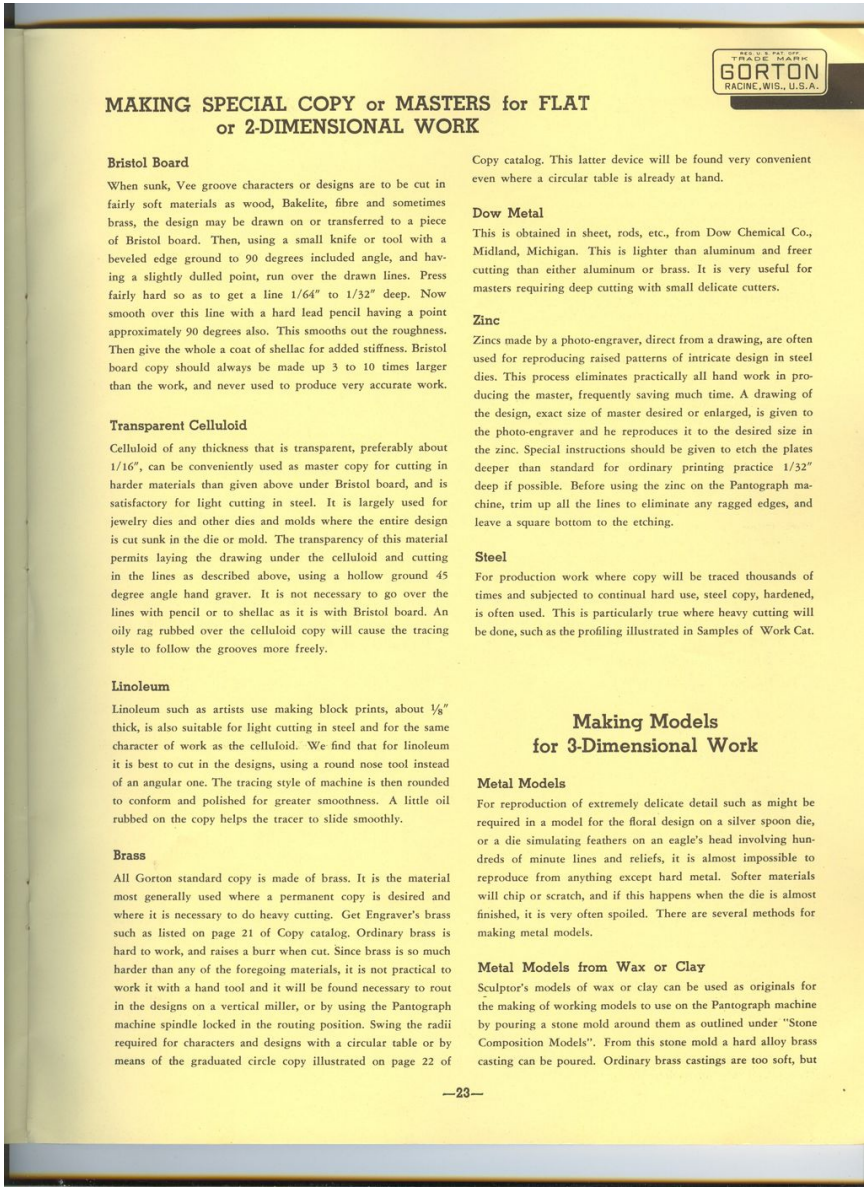
7. The numerous illustrations of actual work, produced with various kinds of copy, in our 32 page Samples of Work catalog will also be helpful in considering copy.

8. Copy is not strictly self-spacing, therefore the spaces between the characters should be adjusted by inserting suitable blank spacers which are furnished with each set of copy. Each line when set in the copy holder should be confined without shake between the clamps furnished, as shown on page 2, Copy catalog.

9. After setting up the copy in the holder, and before engraving, be sure that the holder is firmly against the stop screws "N" or "T" (page 3) in copy holder base. It is then square with table. Do not disturb these stops. They are properly adjusted when machines leave factory, and any change will throw copy holder out of square with table. T slots in the machine table are also parallel with front edge of table. This is also true of T slots or dove-tail grooves in copy holders. This makes it easy to set up work and copy in accurate parallel relation to each other.

10. When several lines of reversed copy are set up in a copy holder, an easy way to check for spelling and position of characters is by making a rubbing with a sheet of tissue, then look on reverse side and read.

Photo 25



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MAKING SPECIAL COPY or MASTERS for FLAT or 2-DIMENSIONAL WORK

Bristol Board

When sunk, Vee groove characters or designs are to be cut in fairly soft materials as wood, Bakelite, fibre and sometimes brass, the design may be drawn on or transferred to a piece of Bristol board. Then, using a small knife or tool with a beveled edge ground to 90 degrees included angle, and having a slightly dulled point, run over the drawn lines. Press fairly hard so as to get a line 1/64" to 1/32" deep. Now smooth over this line with a hard lead pencil having a point approximately 90 degrees also. This smooths out the roughness. Then give the whole a coat of shellac for added stiffness. Bristol board copy should always be made up 3 to 10 times larger than the work, and never used to produce very accurate work.

Transparent Celluloid

Celluloid of any thickness that is transparent, preferably about 1/16", can be conveniently used as master copy for cutting in harder materials than given above under Bristol board, and is satisfactory for light cutting in steel. It is largely used for jewelry dies and other dies and molds where the entire design is cut sunk in the die or mold. The transparency of this material permits laying the drawing under the celluloid and cutting in the lines as described above, using a hollow ground 45 degree angle hand graver. It is not necessary to go over the lines with pencil or to shellac as it is with Bristol board. An oily rag rubbed over the celluloid copy will cause the tracing style to follow the grooves more freely.

Linoleum

Linoleum such as artists use making block prints, about 1/8" thick, is also suitable for light cutting in steel and for the same character of work as the celluloid. We find that for linoleum it is best to cut in the designs, using a round nose tool instead of an angular one. The tracing style of machine is then rounded to conform and polished for greater smoothness. A little oil rubbed on the copy helps the tracer to slide smoothly.

Brass

All Gorton standard copy is made of brass. It is the material most generally used where a permanent copy is desired and where it is necessary to do heavy cutting. Get Engraver's brass such as listed on page 21 of Copy catalog. Ordinary brass is hard to work, and raises a burr when cut. Since brass is so much harder than any of the foregoing materials, it is not practical to work it with a hand tool and it will be found necessary to rout in the designs on a vertical miller, or by using the Pantograph machine spindle locked in the routing position. Swing the radii required for characters and designs with a circular table or by means of the graduated circle copy illustrated on page 22 of Copy catalog. This latter device will be found very convenient even where a circular table is already at hand.

Dow Metal

This is obtained in sheet, rods, etc., from Dow Chemical Co., Midland, Michigan. This is lighter than aluminum and freer cutting than either aluminum or brass. It is very useful for masters requiring deep cutting with small delicate cutters.

Zinc

Zincs made by a photo-engraver, direct from a drawing, are often used for reproducing raised patterns of intricate design in steel dies. This process eliminates practically all hand work in producing the master, frequently saving much time. A drawing of the design, exact size of master desired or enlarged, is given to the photo-engraver and he reproduces it to the desired size in the zinc. Special instructions should be given to etch the plates deeper than standard for ordinary printing practice 1/32" deep if possible. Before using the zinc on the Pantograph machine, trim up all the lines to eliminate any ragged edges, and leave a square bottom to the etching.

Steel

For production work where copy will be traced thousands of times and subjected to continual hard use, steel copy, hardened, is often used. This is particularly true where heavy cutting will be done, such as the profiling illustrated in Samples of Work Cat.

Making Models for 3-Dimensional Work

Metal Models

For reproduction of extremely delicate detail such as might be required in a model for the floral design on a silver spoon die, or a die simulating feathers on an eagle's head involving hundreds of minute lines and reliefs, it is almost impossible to reproduce from anything except hard metal. Softer materials will chip or scratch, and if this happens when the die is almost finished, it is very often spoiled. There are several methods for making metal models.

Metal Models from Wax or Clay

Sculptor's models of wax or clay can be used as originals for the making of working models to use on the Pantograph machine by pouring a stone mold around them as outlined under "Stone Composition Models". From this stone mold a hard alloy brass casting can be poured. Ordinary brass castings are too soft, but

Photo 26

properly alloyed the material can be made extremely hard, so as to withstand pressure of the smallest tracing point without denting or breaking off. Such hard alloy brass models are generally preferred for such delicate designs as are mentioned in the first paragraph.

Metal Models by the Enlarging Process

While the Pantograph machine is primarily a reducing machine, the 3-B and 3-L machines can be used for making enlarged models by removing the cutter from the cutter spindle, and inserting a tracing style in this spindle. Then a special auxiliary cutter spindle is substituted for the conventional tracing style spindle and the driving belt transferred to this spindle. Now by placing an original beneath the cutter spindle and following it with the tracer point, an enlarged reproduction can be cut. Dictaphone wax melted up into a solid block is frequently used for such enlarged models as it cuts freely and still preserves the finest detail. When the wax model has been cut, a stone cast is taken from it in the manner described below under "Stone Composition Models". The stone cast in turn is used for pouring the hard alloy brass working model. In this way, very accurate models can be made, involving the finest detail. This special auxiliary spindle is rigid enough for cutting enlarged models in wood or various plastics also, but cutting metal of any kind should not be attempted.

Cast Iron, Bronze, Aluminum and Glass Models

Any of these materials make good models, the cast iron being practically as good as a steel original for all but the smallest raised designs, on which it is more apt to crumble than steel. Many of the glass companies use cast iron as their men are skilled in working out designs in this material.

Metal Coating of Models

Several spray gun processes are now used for spray coating with almost any metal desired. One of these is known as Metallizing, the Metallizing Company of America, with branches in various sections of the country. By this process a harder metal coating may be sprayed over a soft base, as steel over brass, lead bronze or zinc, etc. We do not recommend the process for coating stone or wood models as the thin metal coating (four to ten thousandths as desired) does not form a perfect bond and tends to loosen and crack under continued pressure of the tracer. See also below, "Material for proof castings and impressions".

Bakelite and Other Plastics Models

These materials make very good models, and can be easily worked by hand or with a milling cutter. Other materials than Bakelite which we recommend are: Catalin, made by the American Catalin Corporation, 1 Park Ave., New York City or Marblette made by the Marblette Corporation, 37-21 Thirtieth St., Long Island City, N.Y. Any of these materials can be obtained in blocks, sheets, and rods. They can be sawed, drilled, planed, carved and polished.

Hard Wood Models

Hard wood can be used but we recommend the plastic materials as being harder and less likely to be dented by the tracing style. The size and shape of smallest tracing style will largely determine the hardness required in the model. When hard wood is used it should be cut or carved on the end grain if possible.

Stone Composition Models

For comparatively simple shapes, having smooth, flowing lines without sharp corners or projections which might chip off, stone models are very practical and the least expensive of all to make. They consist of a powder and liquid which is mixed together and poured into a mold or around the original to be reproduced. The materials recommended, when fully set, in 12 to 30 hours have a tensile strength upwards of 1,000 lbs. per sq. inch with a smooth, hard surface. They do not expand, warp or crack and hold accurately to size and detail. These materials can be turned, planed, drilled, filed or finished and when fully set resemble marble in hardness. The makers issue complete instructions for use. We recommend the following: Lava Compound, made by Stone Pattern Mount Co. of 1660 Foulkrod St., Philadelphia, Pa. also Titanite made by The S. Obermayer Co., 2563 W. 18th St., Chicago, Ill. with branches in Cincinnatti and Pittsburgh, and Dystone manufactured by The Hallemite Mfg. Co., Cleveland, Ohio.

In reproducing from stone composition models, the ground tooth burrs shown on page 3 of Accessories catalog will be found very useful — on account of the many flutes continuously in contact with the work, chatter and possibility of chipping the model is greatly reduced. These burrs will also produce an extremely smooth finish.

Materials for Proof Castings and Impressions

Bismuth Alloys

The Cerro de Pasco Copper Corporation, 44 Wall St., New York City, make a Bismuth Alloy known as Cerrobase, which melts at 255 degrees F. and has a zero shrinkage. This is suitable for making proof castings of dies and molds. It can also be used for models, but is rather soft and easily dented with a sharp tracing style. It is quite strong however and forms a good base for a hard spray gun coating or electro-plate coat of hard chromium. With this treatment it makes a very excellent model. Complete description and instructions for use are issued by its makers.

Putty

Another very satisfactory and inexpensive material which we use altogether for taking impressions of dies and molds is our Gorton Impression Putty, put up in ¼ lb. pieces. This can be driven into the mold and pulled out, retaining its shape better than ordinary plastilene or modelling clay commonly used. The material is listed in Accessories catalog. It it very hard and before using should be softened by keeping in a warm place or kneading with the hands. In using we place it on the end of a hard wood block or, dowel if for a small die, driving it in by striking the wood block with a hammer. To remove from die, pull away the wood block, and if care is used the putty will come with the block. Before applying the putty to die block, the die should be moistened slightly with the breath, or powdered chalk or soapstone sprinkled on, to prevent the putty sticking. If the putty cracks, it can be kneaded together when thoroughly warm.

Photo 27

COPY HOLDERS . . . USE OF TRACING STYLES

Fig. 3—Copy Set up in Copy Holder

Copy Holders

Copy is held on the machine by means of the copy holders provided for that purpose. A number of different styles and sizes are provided. These are illustrated on Page 9 of Accessories catalog. Where special copy is used exclusively, we recommend holder 8-2, or for very large copy plates, holder 36-1. Gorton standard brass copy characters have beveled edges fitting the beveled groove holders. All these holders are interchangeable, can quickly be removed from the machine whenever the work requires different sizes of copy, etc.

Use of Tracing Styles—Kinds

Three different kinds of tracing styles are used with Gorton Standard Pantograph machines. For all cutting of sunk letters and designs from 90 degree Vee groove copy, as shown on page 2 of Copy catalog, style No. 3253-A (page 8, Accessories catalog) 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 286-1 tracing style sets are used. See Accessories catalog, page 8.

For 3-B and 3-L 3-dimensional machines, round nose tracing styles are used a great deal. Such tracing style sets are illustrated on page 8, Accessories catalog.

Care and Use of Style 3253-A

This style should be kept ground to a cone of 90 degrees included angle in a Gorton cutter grinder by means of the 2/10″ dia. collets which can be supplied for this purpose. See page 6, Accessories catalog. If the grinder is not of the collet type, use the small V block attachment furnished, and the small collar which slips on style. All sunk Vee groove copy is made to 90 degree angle and if the style is not accurately ground to this angle and kept sharp, the copies will soon be damaged so as to cause imperfect lettering.

Keep copy grooves clean by rubbing out several times a day with slightly greasy rag. This takes but a few seconds and style moves over the copy with much less effort. The style, when placed in the lines 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 Styles 286-1, 25-1

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 large, the styles and rollers 25-1 are used. Where it is small, and for final finishing, the styles without rollers (286-1) are used.

If the cutter is in the exact ratio of reduction to the styles to which the Pantograph is set, 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 be set to reduce to one-tenth the size of copy, a cutter .06″ diameter must be used with the .6″ roller. It is generally desirable to use the largest roller with a proportionately large cutter to do the rough work of outlining and removing the bulk of the stock, and to use the smaller rollers, or styles alone, with corresponding cutters, only when necessary to reach into fine spaces or corners of the work.

Care and Use of Round Nose Tracing Styles

The same general rules apply as above, except that for accurate work the round nose of the style must be ground to exact radius, as well as the style diameter. The same instructions apply as for grinding round nose cutters, page 31.

Fig. 4 Using Sunk Vee Groove Copy on Machine

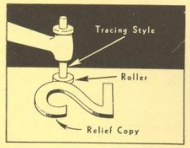


Fig. 5 Using Relief (Raised) Copy on Machine

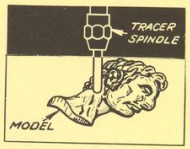
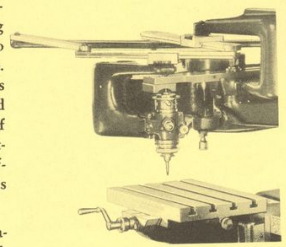


Fig. 6 Using Model on 3-Dimensional Machine

Photo 28

USE OF FORMING GUIDE

For curved work on all Gorton standard type Pantograph machines a hardened steel forming guide is necessary, in addition to the flat copy or master template. A forming guide in operation is illustrated here, also described on page 5 of the Samples of Work catalog. A typical assortment of forming guides for different kinds of curved work is shown below.



Forming Guide in Operation

If the work is of a concave nature, then a forming guide block should be made (preferably of tool steel, hardened) the *exact opposite* of the work or *convex*. On page 13 of Accessories catalog is illustrated *adjustable forming guides*. These guides may be adjusted in a few seconds to almost any desired curvature, and eliminate the necessity for making up expensive hardened guides from a solid block of steel on many jobs. The forming guide is secured to the forming bar by means of four small screws, in the position above. Assuming that your work is secured on work table, and copy on copy holder, you are ready to proceed as follows:

1. Lock spindle floating movement and locate work in relation to copy.
2. Release spindle floating movement and allow former point to come in contact with guide, which should be approximately over work.
3. Extreme care should be observed in locating forming guide in relation to work. Place a round cutter blank, ground to a conical point, in the cutter spindle (or use flexible tracer 68-1, page 6, Accessories catalog) and raise work close to cutter or tracer. Now move cutter point over surface of work by moving tracing style. If the point does not follow the concave or convex surface of the work, then move work table in direction necessary. When your work is in direct relation with the forming guide, the copy will be found out of alignment with work, due to moving the table.
5. Your copy should now be 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.
6. Cover forming guide with grease so former point will slide without friction.

Once this has been done, the engraving can proceed. In other words, after you have located your work, etc., the forming guide can be entirely forgotten as it requires no further attention. The spring in the spindle will always keep the former point secure against the guide, thus causing the cutter to follow the same course of the forming guide surface.

Typical Forming Guides

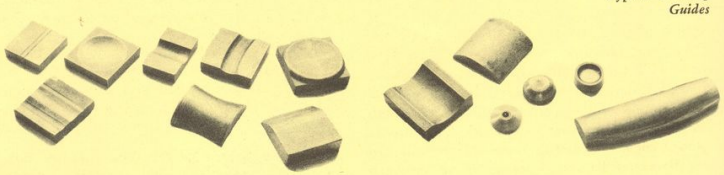


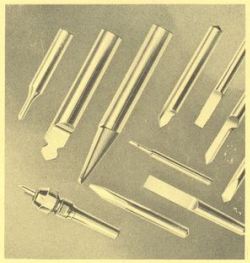
Photo 29

CUTTERS, MATERIALS, CUTTING LUBRICANTS

GORTON
RACINE, WIS., U.S.A.

Cutter Steels

For average work in steel, cast iron and brass the best cutting tools we have found are high speed steel. For a limited amount of work which requires a very keen, hard cutting edge, but no high speeds or feeds, our Special Carbon steel is best. (See page 5, Accessories catalog).



Sample Cutters Used on Gorton Pantograph Machines

Cutters of New Hard Alloys

We have tested the new hard alloy cutters known by trade names such as Carboloy, Widia, Ramet, etc., and recommend them very highly for cutting soft abrasive materials like Bakelite, hard rubber, celluloid and all other synthetic plastics. On these materials such cutters have 15 to 20 times greater life between grinds than the best high speed steels. On tests we have cut the equivalent of 50,000 letters ⅛″ high in Bakelite panels without regrinding cutter, and without the cutter showing appreciable wear. On rubber rolls we have used similar cutters for 50 hours without regrinding. For all this work we list on page 4, Accessories catalog, Carboloy blanks for insertion in 21-2, 22-4 collets (listed in Accessories catalog page 6) also larger dia. blanks for holding in regular collets, and Carboloy tipped Gorton Single Flute Cutters.

Characteristics of New Hard Alloys

These cutters are not suited, however, to work requiring frequent grinding of tip to various angles and clearances, since they are almost as hard as a diamond and require special wheels for grinding. These cutter materials are formed of very hard small grains held together by a bond. On account of this granular structure it is almost impossible to grind such cutters to a fine, keen point for the very finest line engraving, but points small enough for engraving 3/32″ and ⅛″ high characters can be maintained. We have special equipment for grinding these cutters and can supply any angle and clearance, or customer can grind them (see Grinding, page 29).

Ordering New Hard Alloys

These new hard alloys are made in a great many different grades and hardnesses for every condition of service. In ordering such cutters, it is necessary to state the materials desired to cut, and general information regarding operating conditions, to insure receiving correct grade and type.

Diamond Cutters

For engraving lettering on glass and hardened steel, diamond cutters can be furnished, see Accessories catalog, page 4. They will engrave a line .003″ to .005″ deep. They are run at 10,000 R.P.M. or more.

Cutting Lubricants

For all grades of steels shown on the chart, page 34, any good cutting oil or mineral lard oil is best, although it is not always necessary to use a lubricant with small cutters. These oils can be obtained from such concerns as Socony Vacuum Oil Company, Sun Oil Co., E. F. Houghton, etc. For die work or any purpose requiring maximum visibility at all times use an emulsifying oil or some similar light thin compound rather than a dark, heavy base oil. The heavy base oils cover up the work completely and hinder chip removal, making it difficult for the operator to see what he is doing. For cast iron, Bakelite (and associated materials on chart) also brass, no lubricant is necessary. Houghton's "Fropol" is good for cutting stainless steel and Monel metal, although these new steels are made in over 30 different grades, with greatly varying characteristics.

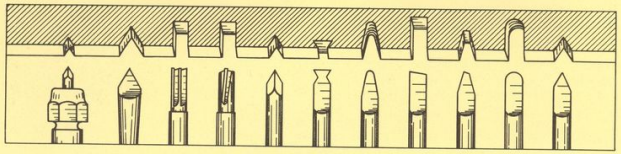
For fine cutting in aluminum or to avoid burrs, use half lard oil and kerosene, mixed. For engraving glass or hardened steel with a diamond cutter, flood the work with turpentine and do not allow to dry.

For cutting plastics or cast iron with the new hard alloy cutters as Carboloy, Widia, etc., no lubricant is necessary.

Photo 30

GORTON
RACINE, WIS., U.S.A.

GRINDING — CUTTER SHAPES — WHEELS



Typical Cutter Points and Cuts

General

The importance of correct grinding of the cutters used on Gorton Pantograph machines cannot be stressed too strongly. Satisfactory work cannot be produced if the cutters have been incorrectly ground. The following instructions on cutter grinding should be read and carefully followed. It is *absolutely essential* that suitable equipment be available for grinding the small cutters used with Gorton machines. If you do not have such equipment, we would suggest the purchase of a Gorton 375-2 or 265-5 grinder, as shown in separate booklet. Both these machines do the same class of work and operate in the same manner. The 375-2 is the more expensive and has many refinements not incorporated in the 265-5.

If no cutter grinding equipment is available, Gorton taper shank cutters can be ground on the Pantograph machine by using the mounted wheels described on page 23, Accessories catalog. Use maximum speed of 8,000 R.P.M. (The attachment will not handle straight shank cutters.) These have a taper shank and fit in the cutter spindle. The cutter is held by Attachment 288-1 illustrated on page 13, Accessories catalog. We do not recommend this method unless it is impossible to purchase a cutter grinder, as it throws grinding dust over the machine which works into the slides and bearings.

Shape of Cutter Points

Practically all of the cutters used in Gorton Pantograph machines are of the single lip type. A typical assortment is illustrated above. Occasionally for special work, 3, 4 or 6 sided cutters like cut above, are used. Standard spiral flute end mills are also used for side milling, as in profiling, and for some types of die-cutting. Reference to pages 2, 3, 4, 5, 6, 7, of Accesssories catalog will show suitable cutters, with collet, etc., for holding. In general, the single lip straight shank cutters are used for heavier work and the Gorton taper shank type for the lighter engraving of small characters and designs.

Single lip cutters are usually ground with a conical point, the angle depending on depth and width of face required. Tables of suggested angles and clearances are given on pages 30, 31, 32.

Grinding Wheels

The wrong grade of wheel will easily draw the temper of small cutters and make them soft. Use the correct grade of wheel. Suggested grades for different purposes are listed on page 23 of Accessories catalog. Dress wheels frequently with the diamond dresser provided, and also listed in Accessories catalog. This is very inexpensive and and will repay its small purchase price many times over. (One is furnished with each Gorton grinder.) Occasionally go over wheels after diamond dressing with a star wheel dresser. Keep wheel free of grease and avoid touching with greasy fingers. Never grind continuously in one spot; keep tool moving. Keep wheel spindle snug and free from vibration.

Special wheels for grinding and lapping the new hard alloys are listed on page 23 of Accessories catalog. These permit much faster grinding and lapping of these materials than heretofore possible. When grinding tungsten carbide tools dry, never dip in a coolant—it may cause checking. Do not force the tool against the wheel—use light pressures only.

Photo 31

REGISTERED TRADE MARK
GORTON
RACINE, WIS., U.S.A.

GRINDING SINGLE FLUTE GORTON CUTTERS

Trueing Grinding Wheel—Fig. 1

Before grinding cutters, true up the grinding wheel using diamond tool 7566-A (Accessories catalog) which is furnished with grinder. This tool has a taper shank and can be inserted in grinders having tool heads fitting Gorton taper shank tools only, or it can be held on its diameter in a ⅜" collet in any of the collet type tool heads. After inserting the diamond, set tool head at approximately the same relation to wheel as shown in Fig. 1. Then swing across face of wheel by rocking the tool head in much the same manner as for grinding the cutter. Avoid taking too heavy a cut from the wheel with the diamond. One to two thousandths of an inch should be the very maximum. If the diamond fails to cut freely, loosen it, and turn slightly in the tool head, so as to present a new and unused portion of the diamond to the wheel.

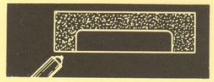


Fig. 1—Trueing Wheel

Rough and Finish Grinding Conical Point — Figs. 2 & 3

Set tool head of grinder to angle desired on cutting edge (see Fig. 2). This usually varies from 30 to 45 degrees, depending on the work desired. Recommended angles for relief characters on steel stamps for various work are given on page 35. For most sunk letter or design engraving on Bakelite panels, brass and metal plates, etc., a 30 degree angle is used (60 degrees included). Now place cutter in tool head and rough grind to approximate size by swinging across face of wheel as with the diamond dresser above. Do not rotate the cutter while in contact with face of wheel but swing straight across, turning cutter slightly *after* or *before* contact with wheel. This will produce a series of flats like Fig. 3, left. Now, grind off the flats and produce a smooth cone by feeding cutter into wheel and rotating at the same time. The finished cone should appear like Fig. 3, right. It should be very smooth and entirely free from wheel marks.

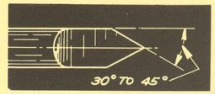


Fig. 2—Set Tool Head to Desired Cutter Angle

Fig. 3—Rough and Finished Conical Shape

Grinding Flat to Center — Figs. 4 and 5

Next operation is grinding the flat exactly to center. For average work this flat may be left a trifle full or oversize, up to half a thousandth. For very small delicate work however, it is absolutely essential to grind this flat *exactly* to center. If the flat is oversize it will be readily apparent after grinding the cone, and the point will appear as in Fig. 4. To correct this, grind the flat to center as in Fig. 5. For cutters used on very small accurate work, examine this point with a magnifying glass to see that flat and cone point coincide *exactly*. Be very careful *not* to grind the flat down *too far*. It is much better to leave it a trifle full.

In grinding off flat, always keep it square with original surface — to do this it will be found necessary to lock the tool head spindle with the indexing plunger set in No. 4 hole. Now using the gauge 9864 furnished with all 717-1 Tool Heads, square up cutter and tighten collet nut. Then turning tool head spindle 90 degrees, plug in next No. 4 hole to square flat with wheel.

Fig. 4—Flat not Ground to Center

Grinding Chip Clearance

The cutter is now the correct angle, with a cutting edge, but it has no chip clearance. This must be provided to keep the back side of cutter from rubbing against the work and heating excessively, and to allow the hot chips to fly off readily. The amount of clearance varies with angle of cutter used. The following table will be found a very good guide in establishing sufficient clearance.

Conical Point Cutter Angles for Clearance

Angle at Cutting Edge	*Clearance Angle*	*Angle at Cutting Edge*	*Clearance Angle*
45	40	25	21
40	35	20	17
35	30	15	13
30	25	10	8
		5	4

Angles in table are for one side of cutter. For instance a cutter having 45 degree angle will have a 90 degree included angle. Now set the tool head for clearance angle desired. If the conical point was ground as described above, to 45 degrees, then a 40 degree clearance angle will be used. Set the tool head back to 40 degrees.

Fig. 5—Grinding Flat to Center

Photo 32

GRINDING SINGLE FLUTE GORTON CUTTERS

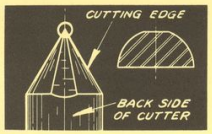


Fig. 6—First Operation in Grinding Clearance

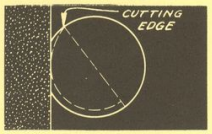


Fig. 7—Second Operation in Grinding Clearance

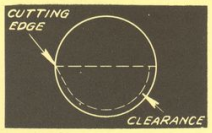


Fig. 8—Section through Cutter after Grinding Clearance

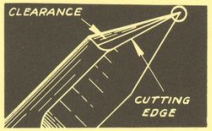


Fig. 9—External View of Fig. 8

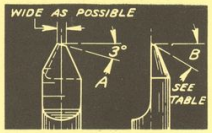


Fig. 10—A "Tipped-off" Cutter

Grinding Chip Clearance — First Operation — Fig. 6

Now feed cutter into face of wheel very gently. Do not rotate, and hold the back (round side) of conical point against wheel. Gradually feed in toward wheel rocking the cutter continuously across face of wheel and without turning, until a flat is ground which runs out *exactly* at the point of cutter, as Fig. 5. Check this very carefully, with a glass if necessary, to be sure you have reached the point with this flat. Be extremely careful not to go beyond. Now you are ready for the final operation.

Grinding Chip Clearance — Second Operation — Figs. 7, 8 and 9

Now, without turning the feed handwheel any further, rough away stock as Fig. 3, then rotate cutter against face of wheel as Fig. 6, grinding away all stock on back of conical side, *up to* the cutting edge. Be extremely careful at this point not to turn the cutter too far, and thus grind away part of the *cutting edge*. All chatter marks must be cleaned up however and to effect this, it is general practice to remove an additional thousandth of an inch, or so, as necessary, on the cutting edge itself. Watch the point designated by small circle in diagrams. *This* is where the cutting is done. If this *very point* is not correctly ground, the cutter will not work, regardless of how perfect it may be farther out on the taper of cone. A section through the cutter should now be like Fig. 8, and an external view like Fig. 9. Here in Fig. 9 we have again called attention to the point that does all the work with the small circle. *Watch this point!*

Tipping Off the Cutter Point — Fig. 10

For engraving hair-line letters up to half a thousandth in depth the cutter point is not flattened or "tipped off". For all ordinary work however, it is best to flatten this point as much as the work will permit, as it is very difficult to retain a keen edge with such a fine point, and when the point breaks down, the cutter immediately fails to cut cleanly. Tipping off is usually done by holding the cutter in the hands at the proper inclination from face of grinding wheel, and touching it very lightly against the wheel, or by dressing with an oil stone as explained below. The angle "A" (Fig. 10) should be approximately 3 degrees. This causes the cutter to bite into the work like a drill, when fed down. The angle "B" (Fig. 10) varies depending on the material to be machined with the cutter. The following table will serve as a guide in maintaining this angle "B".

Rake Angle Table for All Single Flute Cutters

Material to be Cut	*Angle B-Fig. 10*
Tool steel	5-10 degrees
Machine steel	10-15 degrees
Hard Brass	15-20 degrees
Aluminum	20-25 degrees
Bakelite, Celluloid, Wood, Fibre	20-25 degrees

Caution

In all finish grinding operations extreme care should be taken not to anneal (burn) the cutting edge. This can be done by (1) Feeding too fast into the wheel, (2) Removing too much stock as a pass, (3) Holding cutter continuously against the wheel, (4) Failure to keep the wheel true and clean as recommended page 29. The tool head is arranged to rock back and forth across the wheel so as to provide interrupted grinding cuts, thus giving the cutter a chance to cool.

Stoning Small Cutters

The tipped off point of cutter (Fig. 10) can be dressed to size and proper angle, with an oilstone. This can also be done to advantage on the cutting edge and also the flat, but we do not recommend stoning these as it is very difficult to duplicate the angles obtained in the grinder, with the cutter held by hand on an oilstone. Our experience on cutters returned to us for regrinding has proven that cutters are very frequently spoiled by stoning. For this reason we recommend that the cutter be finished entirely on the grinder, (except

Photo 33

GRINDING SINGLE FLUTE GORTON CUTTERS

for dressing the tipped-off point as explained above) unless the stoning is done by an expert who is thoroughly familiar with the job. If stoning is attempted, be sure to keep the flat square. It is very easy to stone a cutter down below the point so it will not cut.

Grinding Square Nose Single Flute Cutters — Fig. 11

When square nose single flute cutters are ground they should always be tipped off as explained above and Fig. 9, unless all the cutting will be done with the side of cutter, in which case the end will not matter, All straight side, (square nose) cutters have of course, clearance ground on the cutting edge as explained above and illustrated Figs. 7 and 8. After grinding the flat to center (which is very easily checked with this style cutter by using a micrometer) clearance is ground by feeding in the required amount toward wheel and turning the cutter until all stock has been removed from the back (round side) right up to the cutting edge, as Figs. 7 and 8. A table of recommended clearances for various diameter Square Nose cutters is given below.

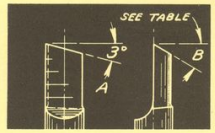


Fig. 11—Square Nose Cutter with Properly Ground Tip

Chip Clearance Table for Square Nose Cutters

Cutter Dia.	Clearance	Cutter Dia.	Clearance
1/10"	.004"	1/4"	.010"
1/8"	.006"	5/16"	.012"
5/32"	.006"	3/8"	.015"
3/16"	.008"	7/16"	.015"
		1/2"	.020"

Example: To grind clearance on a 1/10" dia. Square Nose cutter. Grind the flat as outlined above. Then feed back (round side) of cutter against wheel until it just touches. Then feed in .004" and rotate cutter so as to grind away all material except cutting edge.

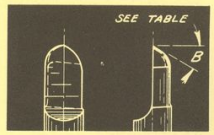


Fig. 12—Properly Ground Ball Nose Cutter

Ball Nose Cutters — Figs. 12, 13 and 14

Gorton 375-2 Grinder with 717-1 Tool Head is designed especially for grinding ball nose cutters. To grind, proceed as follows:

Grinding Chip Clearance on Straight or Tapered Side

Set up in tool head and rough and finish grind for chip clearance and cutting edge as explained above for Square Nose cutters (if the ball nose cutter is to have straight sides like Fig. 12) — or as explained above for Conical point cutters, if the cutter is to have a conical side as in Fig. 14.

Grinding Flat to Center

Before rough grinding the ball nose, be careful to see that the flat is ground exactly to center as explained previously for square nose cutters.

Rough Grinding Chip Clearance on Ball Nose

Tilt the collet tool head to the correct angle in degrees, setting to the Rake Angle Scale, W page 21 and using the tables for clearance angle "B" Fig. 12 recommended for cutters to be used on materials listed there. We find that 10 degrees is suitable for nearly all kinds of work and all but the very softest materials.

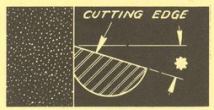


Fig. 13—Tilting Ball Nose Cutter for Clearance

**Use Gauge 9839*

Now insert cutter in collet, using the gauge No. 9839 which fits on flat surface of tool head and is beveled at proper angle for setting all size cutters. With the cutter set by gauge, lock from turning by means of the index pin.

With cutter locked, bring it parallel with grinding wheel and just clearing the grinding wheel, then feed into wheel using longitudinal feed handwheel on base of machine. Now swing head at right angles to wheel, feed cutter in until it touches wheel, using knurled micrometer handwheel X, page 21. Now swing head through an arc of 90 degrees until radius is formed on cutter blank, using stops to provide 90 degrees movement for blending ball into side of cutter.

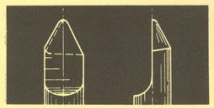


Fig. 14—Ball Nose Cutter with Conical Side

Now release index pin. Rotate collet spindle back and forth, about one-half turn, being careful to keep slightly away from cutting edge. While rotating spindle, swing the tool head through an arc each time spindle is turned. About ten swings of head should rough grind the clearance.

Photo 34

GRINDING THREE and FOUR SIDED CUTTERS

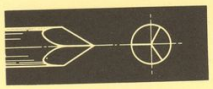


Fig. 15—3-Sided Cutter

Keep your cutters sharp.

A dirty collet or spindle taper will cause cutters to run out of true.

A spindle worn in the taper, or collet hole, or in its bearings is a prolific source of cutter troubles.

Cutters may break or dull from defective steel or wrong temper, but it does not follow that all troubles are from these causes.

Be careful not to feed small cutters beyond the strength of the material of which they are made.

Feed fine small cutters much slower than you would a larger cutter.

Finish Grinding Chip Clearance on Ball Nose

Now feed cutter toward wheel with knurled micrometer handwheel X exactly the amount of clearance in thousandths called for in table page 31. Swing the tool head back and forth, using stop Y, page 21 to limit travel on cutting edge side, until approximate center of ball is reached.

Grinding Three and Four Sided Cutters — Fig. 15

Three or four sided cutters are sometimes used for cutting small steel stamps and other small engraving. They produce a very smooth finish. Tables below give the grinding angle necessary to obtain any desired cutting edge angle. The index plate on collet spindle of grinder tool head has index holes numbered 3, 4 etc. — for indexing to grind three and four sides. To do this, proceed as follows:

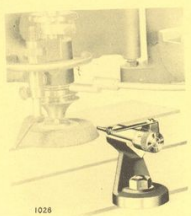
Grinding Clearance Angle

Tighten the cutter in collet of tool head, set the tool head to the proper clearance angle as table below. For example: you are grinding a 3 sided cutter to 45 degrees cutting edge. Referring to the table gives 26½ degrees clearance. Set tool head to 26½ degrees and grind each flat exactly to the point. Do not loosen cutter in collet between index settings.

Table of Clearance Angles for 3 and 4 Sided Cutters

3 Sides Degrees	*Angle of Clearance Degrees*	*4 Sides Degrees*	*Angle of Clearance Degrees*
45	26½	45	35½
40	23	40	30
35	19½	35	25½
30	16	30	22½
25	13	25	18½
20	10½	20	14½
15	7½	15	10
10	5	10	7
5	2½	5	3½

GRINDING CUTTERS WITH ATTACHMENT 288-1 ON PANTOGRAPH MACHINES
(See also Page 13 Accessories Catalog)



Grinding Cutter with Attachment 288-1

First: Insert Pantograph style into hole in copy holder. This holds cutter head rigid. If cutter head is equipped with depth gauge, loosen foot nut and swing foot outward. Now insert grinding wheel and bolt cutter holder base in place, with cutter point at inside edge of wheel, all as photo at lower right.

Remove cutter holder by lifting spring slightly and insert cutter tightly, using small wrench. Replace cutter holder and grind cutter point to the proper angle by revolving cutter and shifting table with cross slides.

With cutter pointed as desired, it must be ground for clearance, as shown on Fig. 7, page 30, which means grinding away the metal back of cutting edge so that cutter will cut free and raise no burr on work. To grind this clearance, table must be shifted slightly so that wheel will grind above the cutter point.

By rotating cutter (half turn) back and forth, clearance can be ground without actually grinding the point and cutting edge more than just enough to bring it to a sharp edge. Remove point slightly with a fine oilstone.

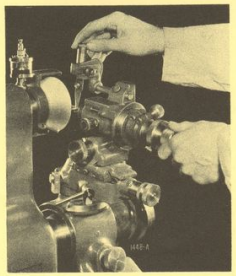
Photo 35

SUGGESTIONS ON OPERATION OF CUTTERS

Grinding Very Fine Cutter Points

Most of the difficulties experienced when using extremely small cutters on small lettering in dies and stamps are caused by improper grinding. This applies especially to the *very cutter point* where possibly only .01″ of the point is used.

This very *point* therefore, is the part that *must* be accurately sharpened. If the actual *point* is not perfect, a cutter that may be beautifully ground in all other respects is simply no good for doing the work. Examine the point with a good magnifying glass, and do not try to use the cutter until you are satisfied that it is in perfect condition for doing the kind of work you have a right to expect of it. When trouble is experienced, usually the point is *burned,* or the flat is either *too high* or *too low*. Perhaps the clearance does not run clear out to the *point*. Sometimes stoning off the flat with a small fine oil stone will make the cutting edge keener.



Grinding a Spiral Flute Cutter on 375-2 Cutter Grinder with 717-1 Universal Tool Head

The *only* way by which a cutter point can be made to run *absolutely perfect,* is by sharpening in the cutter spindle in which it runs. Most Gorton machines have provision for removing the cutter spindle from the machine and placing in a V block Tool Head on the Cutter grinder. The cutter is then ground to the conventional shape just as previously explained, all without removing it from the cutter spindle. We find this procedure unnecessary for any but the very finest type and steel stamp work, however. For such small, fine sunk letters 1/32″ to 1/16″ high and say, .005″ to .015″ depth of cut, grind the cutter in place in the spindle of the machine to an angle of about 25 degrees. Trace the copy *evenly* and *steadily* as a sudden jerk will be almost certain to break off the cutter point. A correctly ground cutter should engrave from 30 to 50 characters this size in annealed tool steel before resharpening.

Operation of Cutters—General

After the cutter has been placed in operation, it must be kept sharp and with proper clearance at all times. This is particularly important when running at extremely high speeds as a dull cutter burns quickly. If the cutter raises a burr, it is pretty certain to be dull or without clearance, or both. Cutters will not always cut the same kind of material with equal facility as materials vary in density and hardness, even in the same piece.

A dirty or worn collet may cause a cutter to run out of true. Loose or badly worn spindle bearings will frequently cause the cutter to break.

Gorton Taper Shank Cutters

Wring the cutter (if taper shank) in the spindle very tight. Do not continue with a cutter if it comes loose, or the spindle will be worn so that no cutter can be held properly. If this happens, check taper of cutter in spindle by rubbing on a little Prussian blue. The cutter should fit more tightly at small end than large. If the blue shows otherwise, and the spindle is old, it is probably worn out of true and needs replacing.

Fig. 16 — Stoning a very slight flat on the point of the cutting edge of a square nose single flute cutter will make it produce a smoother finish, especially in cutting brass.

Fig. 17 — Vertical sides of considerable depth can be milled faster and more accurately if the cutter be relieved as shown, to the same depth as for chip clearance back of the cutting edge.

Fig. 18—In milling irregular contours, etc., faster cutting will be done if the direction of feed is upward as shown, instead of down.

Fig. 19 — For milling narrow taper slots, best results will be obtained by grinding a cutter to the full bottom width of the slot and cutting this the full depth as shown at left. The taper sides are then milled out using a taper cutter.

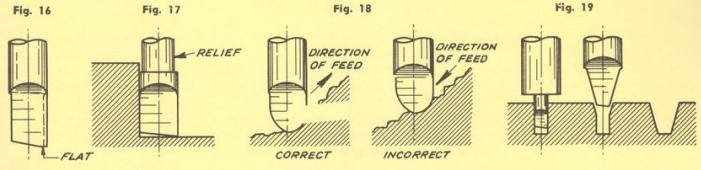


Photo 36

GORTON
TRADE MARK
RACINE, WIS., U.S.A.

CUTTER SPEED CHART

Revolutions per minute for High Speed Steel Cutters, single flute type.
Use two-thirds of speeds shown for 2 and 4, one-half speeds for 6 flute end mills.

Cutter Diameter (at cutting point)	1/32"	1/16"	1/8"	3/16"	1/4"	5/16"	3/8"	7/16"	1/2"
Hard Wood *(650-800 Ft. per Min.)*	10,000 to 20,000	Ditto	Ditto	Ditto	Ditto	9,000	8,000	7,000	6,000
*Bakelite *(170-250 Ft. per Min.)*	10,000	8,000	6,000	4,000	3,000	2,200	1,800	1,500	1,300
†Engraver's Brass and Aluminum *(375-425 Ft. per Min.)*	10,000 to 15,000	10,000 to 15,000	10,000 to 15,000	8,000	6,000	5,000	4,000	3,500	3,000
Cast Iron *(130-250 Ft. per Min.)*	8,000	7,500	5,500	3,500	2,500	2,000	1,650	1,400	1,200
Hard Bronze and Machine Steel *(80-200 Ft. per Min.)*	7,000	6,000	3,000	2,200	1,600	1,200	975	800	700
Annealed Tool Steel *(70-100 Ft. per Min.)*	5,000	4,500	2,300	1,600	1,200	1,000	850	725	600
Stainless, Monel, Etc. *(45-75 Ft. per Min.)*	3,500	2,750	1,400	1,050	700	575	500	435	350
Very Hard Die and Alloy Steels *(30-45 Ft. per Min.)*	2,000	1,250	800	600	475	400	350	300	250

*Also celluloid, hard rubber, pearl, ivory and synthetic plastics.

Tungsten or Tantalum carbide cutters can be run at much higher speeds on wood, Bakelite, brass, aluminum, and cast iron than given in table. They are not recommended in these small sizes, for harder materials.

†Slightly lower speeds for ordinary brass, zinc, copper, silver, gold, soft bronze, German silver.

Diamond cutters—same speeds for all materials as for cutting in brass with steel cutters.

USING THE CHART

The speeds worked out on the chart above are the result of our own experience over a period of years, coupled with what is considered good modern practice. In using the chart it must be kept in mind that the speeds recommended will vary greatly, depending on the depth of cut, and particularly the rate at which the cutter is fed through the work. Since Gorton machines are fed manually the rate of feed is subject to a wide variation in the hands of individual operators, which will in many cases affect the spindle speeds used. The experienced operator will have found by trial the speeds and feeds best suited to his own work and for him this chart is only a means of comparison. It will be found invaluable however, for the inexperienced operator or persons not familiar with the operation of the small, high speed cutters used in Gorton machines.

ROUGHING CUTS

Considerable latitude has been given in the recommended Ft. per Min. cutting speeds listed after the various materials. In most instances the minimum Ft. per Min. speeds were used for calculating the RPM given on the chart. Consequently these chart speeds may be used for most medium roughing cuts. For a very heavy roughing cut, where considerable stock is removed, it may be necessary to use slower speeds than the chart. For these cuts much depends on the rate at which cutter is fed through the work. For any given depth of cut the speed must be decreased as the feed is increased.

FINISHING CUTS

Considerably higher speeds than given on the chart may be used for finishing cuts where a very slight amount of stock is removed. Take for instance the chart speeds for cutting cast iron. These are based on the lowest, 130 Ft. per Min. rate and are intended for use in taking roughing cuts. For finishing in some instances, the rate of 250 Ft. per Min. might be used, which would mean speeds almost double those given on the chart.

HELPFUL SUGGESTIONS

With all Pantograph machines it is best to run cutters at highest speeds possible, and remove stock with several light, fast cuts rather than one heavy cut at slower spindle speeds. Always use the highest speed possible without burning the cutter. In cutting steel, and all hard materials, start with a slow speed and work up to the fastest which cutter will stand without losing its cutting edge. Sometimes it may be advisable to sacrifice cutter life in order to obtain the smoother finish possible at higher speeds. With a little experience, the operator can feel with the Pantograph when the cutter is running at maximum efficiency.

Photo 37

CUTTING STEEL DIES AND STAMPS

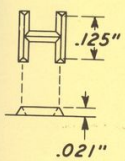
GORTON
RACINE, WIS., U.S.A.

Die Steel

A high grade of well annealed tool steel should be used. Very tough steels may be necessary on some stamps intended for severe service, but for most work a freer cutting steel will be just as serviceable and much easier to cut. The time and trouble saved in cutting more than makes up for the higher cost of a good steel. Use enough lubricant to avoid burning the cutters. Single lip cutters cut freest but 3 or 4 sided cutters are sometimes useful for finishing as they leave a smooth finish.

Proportions of Steel Stamp Letters

A practical way to proportion steel stamps is to make the raised height of stamp about 1/6 of the height of the characters (on the center line). For instance, if the letter is .125″ printed height, then the raised height of stamp would be .021″. (See diagram.)



For roughing always use the largest diameter tracing style possible. If your tracing style is too large to pass through some portions of the copy, that will make no difference. Raise cutter out of work and pass the style to the next portion of copy where it will trace through, etc. Three sizes of cutters are generally used, the last one for removing only 3 or 4 thousandths of stock. Eighty percent of material is removed with the first cut.

Corners of Letters

Corners can be removed by "stepping up." Set the cutter at half depth when stamp is otherwise finished, and use a tracing style as small as possible without under-cutting.

Recommended Angles for Relief Characters

The taper desired on relief characters will determine the angle to which the cutter is ground. On stamps designed for hard use, such as large, heavy steel stamps, the characters should be cut with a cutter having an angle of 37 to 45 degrees (on a side) on the cutting edge. For light steel stamps, to be used on brass, copper, lead and other soft materials, 25 to 35 degrees will be found strong enough. For stamps to be used on wood, 10 or 15 degrees on the cutting edge is sufficient.

Determining Cutter Angles for Sunk Characters

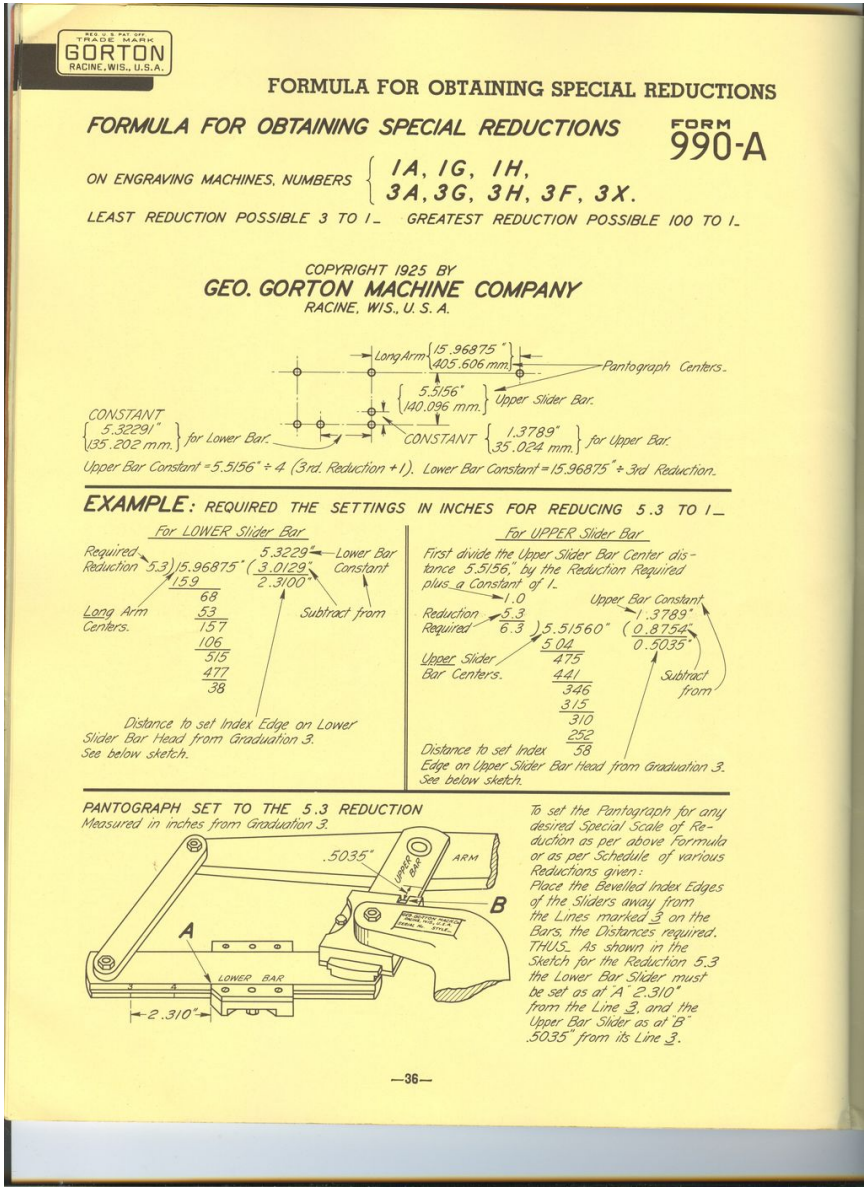
It may frequently be necessary to engrave sunk characters to a predetermined width of face. To find this, when the angle of cutter is known, simply multiply by the proper tangent, then multiply the result by two (2). Below is a table of tangents. (More complete tables can be found in any Machinist Hand Book.)

15	degrees	=	.267
17	"	=	.305
20	"	=	.364
22.5	"	=	.414
25	"	=	.466
30	"	=	.577
33	"	=	.649
35	"	=	.700
37.5	"	=	.767
40	"	=	.839
42.5	"	=	.916
45	"	=	1.000

Example: If a 60 degree included angle cutter is being used and depth of cut is .012″, multiply the tangent of 30 degrees (.577) by the depth, which will equal .0069″. Multiply this by two which will equal .0138″, or the face of cut. If the cutter is to be used with the point "tipped off", proceed as above and add the diameter of the cutter tip.

NOTE: The width of face in all cases above is taken at surface of work.

Photo 38



GORTON
TRADE MARK
RACINE, WIS., U.S.A.

FORMULA FOR OBTAINING SPECIAL REDUCTIONS

FORMULA FOR OBTAINING SPECIAL REDUCTIONS

FORM 990-A

ON ENGRAVING MACHINES, NUMBERS { 1A, 1G, 1H, 3A, 3G, 3H, 3F, 3X.

LEAST REDUCTION POSSIBLE 3 TO 1. GREATEST REDUCTION POSSIBLE 100 TO 1.

Upper Bar Constant = 5.5156" ÷ 4 (3rd. Reduction + 1). Lower Bar Constant = 15.96875" ÷ 3rd. Reduction.

EXAMPLE: REQUIRED THE SETTINGS IN INCHES FOR REDUCING 5.3 TO 1.

For LOWER Slider Bar

Required Reduction 5.3) 15.96875" (3.0129"

Long Arm Centers: 159, 68, 53, 157, 106, 515, 477, 38

5.3229" Lower Bar Constant − 3.0129" = 2.3100" Subtract from

Distance to set Index Edge on Lower Slider Bar Head from Graduation 3. See below sketch.

For UPPER Slider Bar

First divide the Upper Slider Bar Center distance 5.5156" by the Reduction Required plus a Constant of 1.

1.0 + Reduction Required 5.3 = 6.3) 5.5156" (0.8754"

Upper Slider Bar Centers: 5.04, 475, 441, 346, 315, 310, 252, 58

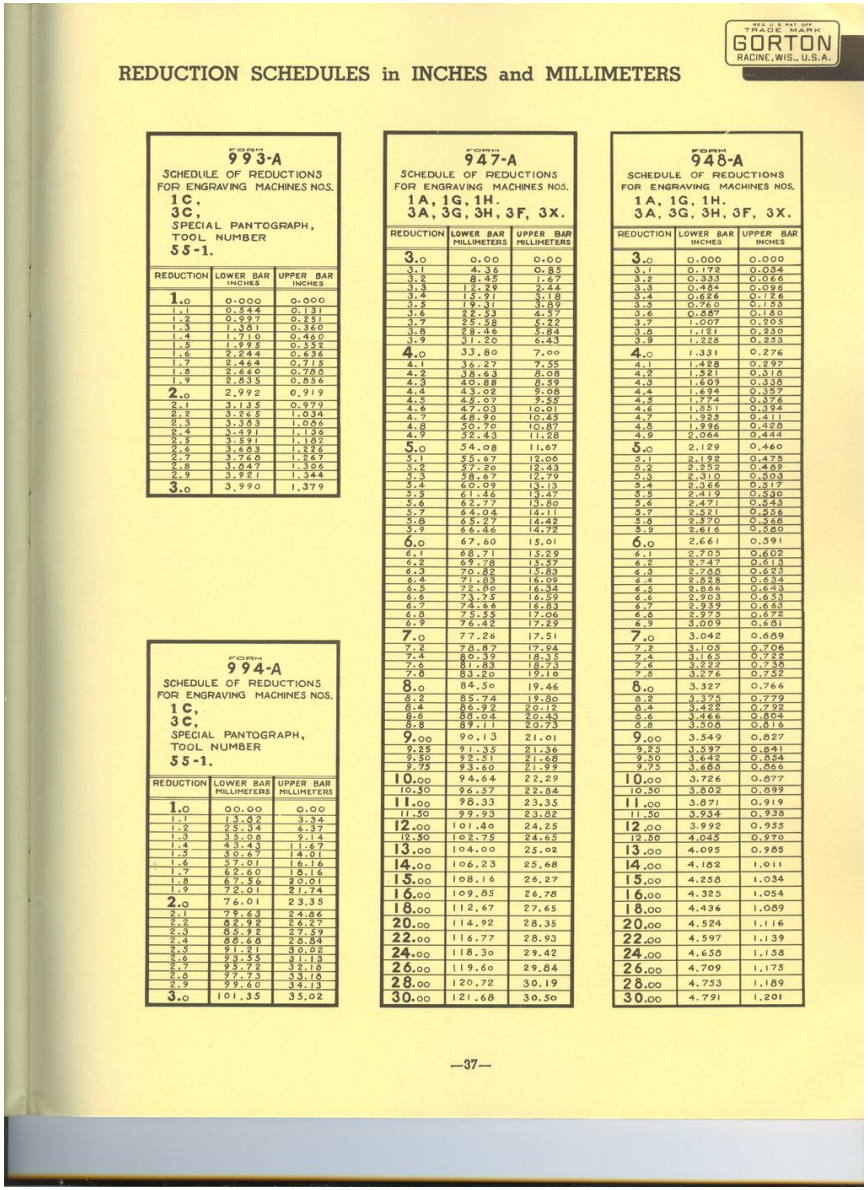
1.3789" Upper Bar Constant − 0.8754" = 0.5035" Subtract from

Distance to set Index Edge on Upper Slider Bar Head from Graduation 3. See below sketch.

PANTOGRAPH SET TO THE 5.3 REDUCTION
Measured in inches from Graduation 3.

To set the Pantograph for any desired Special Scale of Reduction as per above Formula or as per Schedule of various Reductions given: Place the Bevelled Index Edges of the Sliders away from the Lines marked 3 on the Bars, the Distances required. THUS. As shown in the Sketch for the Reduction 5.3 the Lower Bar Slider must be set as at "A" 2.310" from the Line 3, and the Upper Bar Slider as at "B" .5035" from its Line 3.

Photo 39



REG. U.S. PAT. OFF. TRADE MARK
GORTON
RACINE, WIS., U.S.A.

REDUCTION SCHEDULES in INCHES and MILLIMETERS

FORM
993-A
SCHEDULE OF REDUCTIONS
FOR ENGRAVING MACHINES NOS.
1C,
3C,
SPECIAL PANTOGRAPH,
TOOL NUMBER
55-1.

REDUCTION	LOWER BAR INCHES	UPPER BAR INCHES
1.0	0.000	0.000
1.1	0.544	0.131
1.2	0.997	0.251
1.3	1.361	0.360
1.4	1.710	0.460
1.5	1.995	0.552
1.6	2.244	0.636
1.7	2.464	0.715
1.8	2.660	0.780
1.9	2.835	0.856
2.0	2.992	0.919
2.1	3.135	0.979
2.2	3.265	1.034
2.3	3.383	1.086
2.4	3.491	1.136
2.5	3.591	1.182
2.6	3.683	1.226
2.7	3.768	1.267
2.8	3.847	1.305
2.9	3.921	1.344
3.0	3.990	1.379

FORM
994-A
SCHEDULE OF REDUCTIONS
FOR ENGRAVING MACHINES NOS.
1C,
3C,
SPECIAL PANTOGRAPH,
TOOL NUMBER
55-1.

REDUCTION	LOWER BAR MILLIMETERS	UPPER BAR MILLIMETERS
1.0	00.00	0.00
1.1	13.82	3.34
1.2	25.34	6.37
1.3	35.08	9.14
1.4	43.43	11.67
1.5	50.67	14.01
1.6	57.01	16.16
1.7	62.60	18.16
1.8	67.56	20.01
1.9	72.01	21.74
2.0	76.01	23.35
2.1	79.63	24.86
2.2	82.92	26.27
2.3	85.92	27.59
2.4	88.68	28.84
2.5	91.21	30.02
2.6	93.55	31.13
2.7	95.72	32.18
2.8	97.73	33.18
2.9	99.60	34.13
3.0	101.35	35.02

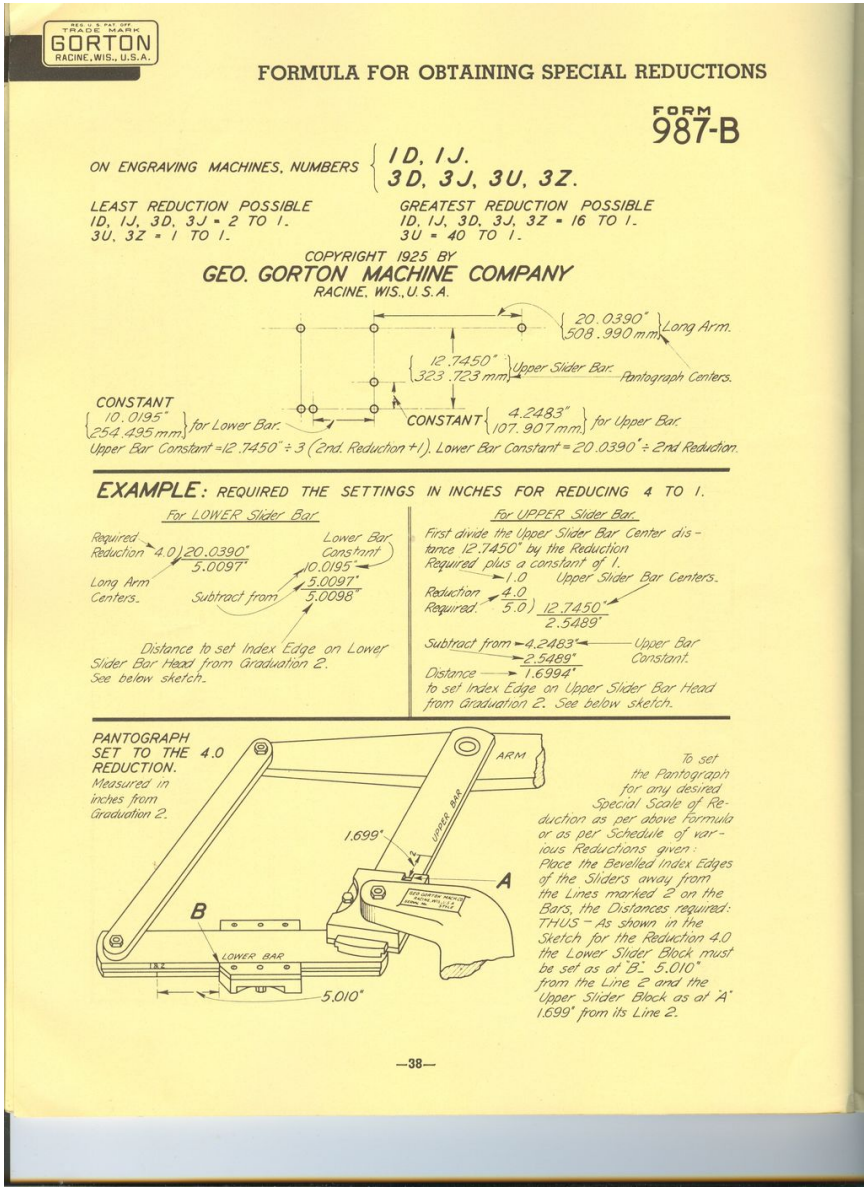
FORM
947-A
SCHEDULE OF REDUCTIONS
FOR ENGRAVING MACHINES NOS.
1A, 1G, 1H.
3A, 3G, 3H, 3F, 3X.

REDUCTION	LOWER BAR MILLIMETERS	UPPER BAR MILLIMETERS
3.0	0.00	0.00
3.1	4.36	0.85
3.2	8.45	1.67
3.3	12.29	2.44
3.4	15.91	3.18
3.5	19.31	3.89
3.6	22.53	4.57
3.7	25.58	5.22
3.8	28.46	5.84
3.9	31.20	6.43
4.0	33.80	7.00
4.1	36.27	7.55
4.2	38.63	8.08
4.3	40.88	8.59
4.4	43.02	9.08
4.5	45.07	9.55
4.6	47.03	10.01
4.7	48.90	10.45
4.8	50.70	10.87
4.9	52.43	11.28
5.0	54.08	11.67
5.1	55.67	12.06
5.2	57.20	12.43
5.3	58.67	12.79
5.4	60.09	13.13
5.5	61.46	13.47
5.6	62.77	13.80
5.7	64.04	14.11
5.8	65.27	14.42
5.9	66.46	14.72
6.0	67.60	15.01
6.1	68.71	15.29
6.2	69.78	15.57
6.3	70.82	15.83
6.4	71.83	16.09
6.5	72.80	16.34
6.6	73.75	16.59
6.7	74.66	16.83
6.8	75.55	17.06
6.9	76.42	17.29
7.0	77.26	17.51
7.2	78.87	17.94
7.4	80.39	18.35
7.6	81.83	18.73
7.8	83.20	19.10
8.0	84.50	19.46
8.2	85.74	19.80
8.4	86.92	20.12
8.6	88.04	20.43
8.8	89.11	20.73
9.00	90.13	21.01
9.25	91.35	21.36
9.50	92.51	21.68
9.75	93.60	21.99
10.00	94.64	22.29
10.50	96.57	22.84
11.00	98.33	23.35
11.50	99.93	23.82
12.00	101.40	24.25
12.50	102.75	24.65
13.00	104.00	25.02
14.00	106.23	25.68
15.00	108.16	26.27
16.00	109.85	26.78
18.00	112.67	27.65
20.00	114.92	28.35
22.00	116.77	28.93
24.00	118.30	29.42
26.00	119.60	29.84
28.00	120.72	30.19
30.00	121.68	30.50

FORM
948-A
SCHEDULE OF REDUCTIONS
FOR ENGRAVING MACHINES NOS.
1A, 1G, 1H.
3A, 3G, 3H, 3F, 3X.

REDUCTION	LOWER BAR INCHES	UPPER BAR INCHES
3.0	0.000	0.000
3.1	0.172	0.034
3.2	0.333	0.066
3.3	0.484	0.096
3.4	0.626	0.126
3.5	0.760	0.153
3.6	0.887	0.180
3.7	1.007	0.205
3.8	1.121	0.230
3.9	1.228	0.253
4.0	1.331	0.276
4.1	1.428	0.297
4.2	1.521	0.316
4.3	1.609	0.336
4.4	1.694	0.357
4.5	1.774	0.376
4.6	1.851	0.394
4.7	1.922	0.411
4.8	1.996	0.428
4.9	2.066	0.444
5.0	2.129	0.460
5.1	2.192	0.475
5.2	2.252	0.489
5.3	2.310	0.503
5.4	2.366	0.517
5.5	2.419	0.530
5.6	2.471	0.543
5.7	2.521	0.556
5.8	2.570	0.568
5.9	2.616	0.580
6.0	2.661	0.591
6.1	2.705	0.602
6.2	2.747	0.613
6.3	2.788	0.623
6.4	2.828	0.634
6.5	2.866	0.643
6.6	2.903	0.653
6.7	2.939	0.663
6.8	2.975	0.672
6.9	3.009	0.681
7.0	3.042	0.689
7.2	3.105	0.706
7.4	3.165	0.722
7.6	3.222	0.736
7.8	3.276	0.752
8.0	3.327	0.766
8.2	3.375	0.779
8.4	3.422	0.792
8.6	3.466	0.804
8.8	3.508	0.816
9.00	3.549	0.827
9.25	3.597	0.841
9.50	3.642	0.854
9.75	3.685	0.866
10.00	3.726	0.877
10.50	3.802	0.899
11.00	3.871	0.919
11.50	3.934	0.938
12.00	3.992	0.955
12.50	4.045	0.970
13.00	4.095	0.985
14.00	4.182	1.011
15.00	4.258	1.034
16.00	4.325	1.054
18.00	4.436	1.089
20.00	4.524	1.116
22.00	4.597	1.139
24.00	4.658	1.158
26.00	4.709	1.175
28.00	4.753	1.189
30.00	4.791	1.201

Photo 40



GORTON
RACINE, WIS., U.S.A.

FORMULA FOR OBTAINING SPECIAL REDUCTIONS

FORM 987-B

ON ENGRAVING MACHINES, NUMBERS { 1D, 1J. / 3D, 3J, 3U, 3Z.

LEAST REDUCTION POSSIBLE
1D, 1J, 3D, 3J = 2 TO 1.
3U, 3Z = 1 TO 1.

GREATEST REDUCTION POSSIBLE
1D, 1J, 3D, 3J, 3Z = 16 TO 1.
3U = 40 TO 1.

GEO. GORTON MACHINE COMPANY
RACINE, WIS., U.S.A.

20.0390" / 508.990 mm Long Arm.
12.7450" / 323.723 mm Upper Slider Bar. Pantograph Centers.
CONSTANT 10.0195" / 254.495 mm for Lower Bar.
CONSTANT 4.2483" / 107.907 mm for Upper Bar.

Upper Bar Constant = 12.7450" ÷ 3 (2nd. Reduction + 1). Lower Bar Constant = 20.0390" ÷ 2nd Reduction.

EXAMPLE: REQUIRED THE SETTINGS IN INCHES FOR REDUCING 4 TO 1.

For LOWER Slider Bar.

Required Reduction 4.0) 20.0390" / 5.0097"
Lower Bar Constant 10.0195"
Long Arm Centers. Subtract from 5.0097" / 5.0098"

Distance to set Index Edge on Lower Slider Bar Head from Graduation 2. See below sketch.

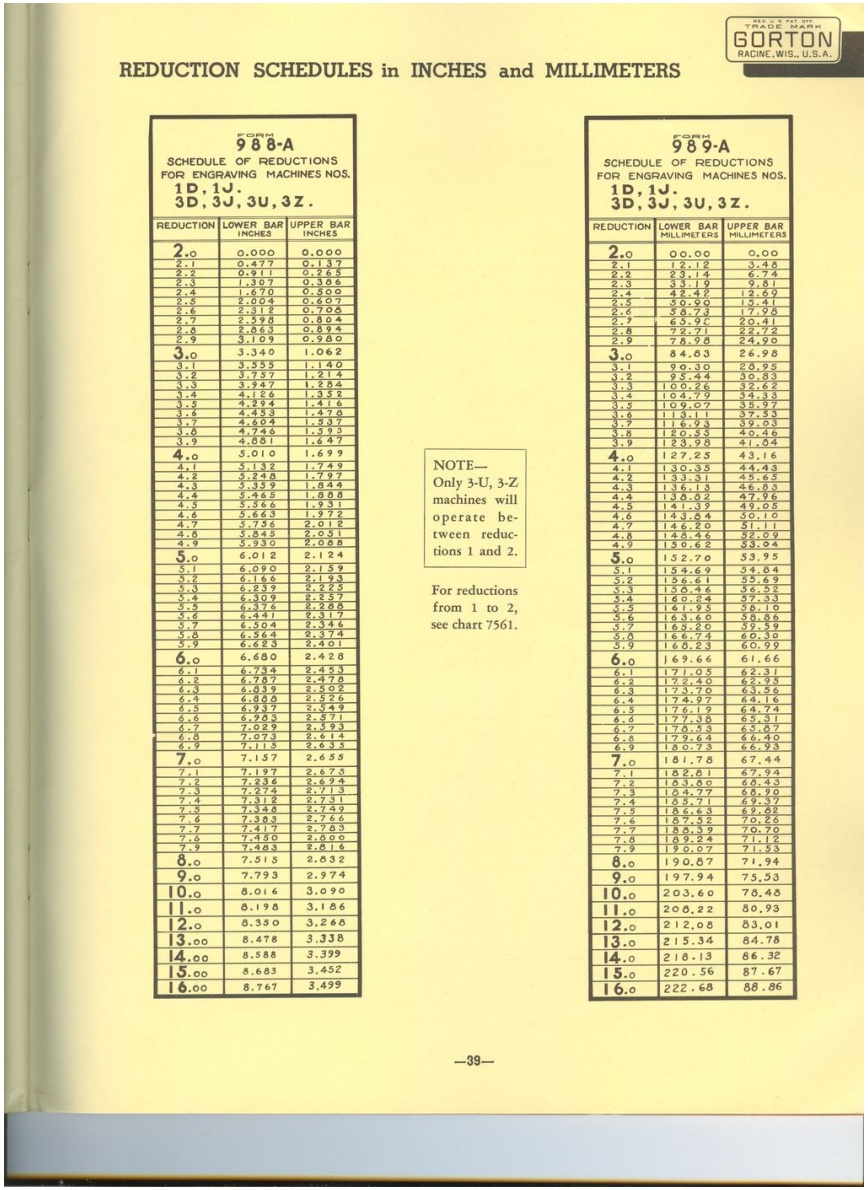
For UPPER Slider Bar.

First divide the Upper Slider Bar Center distance 12.7450" by the Reduction Required plus a constant of 1.
1.0 Upper Slider Bar Centers.
Reduction Required: 4.0 / 5.0) 12.7450" / 2.5489"
Subtract from 4.2483" Upper Bar Constant. 2.5489"
Distance 1.6994"
to set Index Edge on Upper Slider Bar Head from Graduation 2. See below sketch.

PANTOGRAPH SET TO THE 4.0 REDUCTION. Measured in inches from Graduation 2.

To set the Pantograph for any desired Special Scale of Reduction as per above formula or as per Schedule of various Reductions given: Place the Bevelled Index Edges of the Sliders away from the Lines marked 2 on the Bars, the Distances required: THUS – As shown in the Sketch for the Reduction 4.0 the Lower Slider Block must be set as at "B" 5.010" from the Line 2 and the Upper Slider Block as at "A" 1.699" from its Line 2.

Photo 41



REDUCTION SCHEDULES in INCHES and MILLIMETERS

REG. U.S. PAT. OFF. TRADE MARK GORTON RACINE, WIS., U.S.A.

FORM 988-A
SCHEDULE OF REDUCTIONS FOR ENGRAVING MACHINES NOS. 1D, 1J. 3D, 3J, 3U, 3Z.

REDUCTION	LOWER BAR INCHES	UPPER BAR INCHES
2.0	0.000	0.000
2.1	0.477	0.137
2.2	0.911	0.265
2.3	1.307	0.386
2.4	1.670	0.500
2.5	2.004	0.607
2.6	2.312	0.708
2.7	2.598	0.804
2.8	2.863	0.894
2.9	3.109	0.980
3.0	3.340	1.062
3.1	3.555	1.140
3.2	3.757	1.214
3.3	3.947	1.284
3.4	4.126	1.352
3.5	4.294	1.416
3.6	4.453	1.478
3.7	4.604	1.537
3.8	4.746	1.593
3.9	4.881	1.647
4.0	5.010	1.699
4.1	5.132	1.749
4.2	5.248	1.797
4.3	5.359	1.844
4.4	5.465	1.888
4.5	5.566	1.931
4.6	5.663	1.972
4.7	5.756	2.012
4.8	5.845	2.051
4.9	5.930	2.088
5.0	6.012	2.124
5.1	6.090	2.159
5.2	6.166	2.193
5.3	6.239	2.225
5.4	6.309	2.257
5.5	6.376	2.288
5.6	6.441	2.317
5.7	6.504	2.346
5.8	6.564	2.374
5.9	6.623	2.401
6.0	6.680	2.428
6.1	6.734	2.453
6.2	6.787	2.478
6.3	6.839	2.502
6.4	6.889	2.526
6.5	6.937	2.549
6.6	6.983	2.571
6.7	7.029	2.593
6.8	7.073	2.614
6.9	7.115	2.633
7.0	7.157	2.655
7.1	7.197	2.675
7.2	7.236	2.694
7.3	7.274	2.713
7.4	7.312	2.731
7.5	7.348	2.749
7.6	7.383	2.766
7.7	7.417	2.783
7.8	7.450	2.800
7.9	7.483	2.816
8.0	7.515	2.832
9.0	7.793	2.974
10.0	8.016	3.090
11.0	8.198	3.186
12.0	8.350	3.268
13.00	8.478	3.338
14.00	8.588	3.399
15.00	8.683	3.452
16.00	8.767	3.499

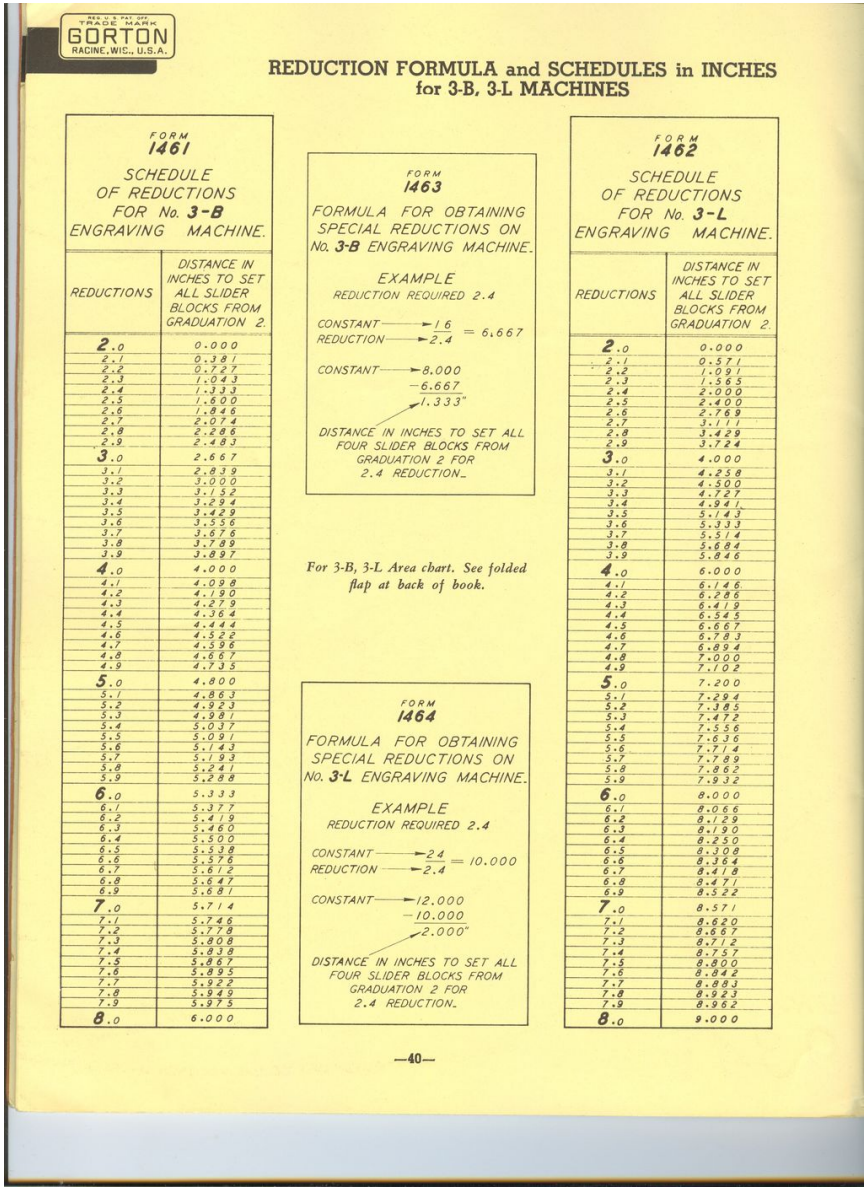
NOTE—
Only 3-U, 3-Z machines will operate between reductions 1 and 2.

For reductions from 1 to 2, see chart 7561.

FORM 989-A
SCHEDULE OF REDUCTIONS FOR ENGRAVING MACHINES NOS. 1D, 1J. 3D, 3J, 3U, 3Z.

REDUCTION	LOWER BAR MILLIMETERS	UPPER BAR MILLIMETERS
2.0	00.00	0.00
2.1	12.12	3.48
2.2	23.14	6.74
2.3	33.19	9.81
2.4	42.42	12.69
2.5	50.90	15.41
2.6	58.73	17.98
2.7	65.96	20.41
2.8	72.71	22.72
2.9	78.98	24.90
3.0	84.83	26.98
3.1	90.30	28.95
3.2	95.44	30.83
3.3	100.26	32.62
3.4	104.79	34.33
3.5	109.07	35.97
3.6	113.11	37.53
3.7	116.93	39.03
3.8	120.55	40.46
3.9	123.98	41.84
4.0	127.25	43.16
4.1	130.35	44.43
4.2	133.31	45.65
4.3	136.13	46.83
4.4	138.82	47.96
4.5	141.39	49.05
4.6	143.84	50.10
4.7	146.20	51.11
4.8	148.46	52.09
4.9	150.62	53.04
5.0	152.70	53.95
5.1	154.69	54.84
5.2	156.61	55.69
5.3	158.46	56.52
5.4	160.24	57.33
5.5	161.95	58.10
5.6	163.60	58.86
5.7	165.20	59.59
5.8	166.74	60.30
5.9	168.23	60.99
6.0	169.66	61.66
6.1	171.05	62.31
6.2	172.40	62.95
6.3	173.70	63.56
6.4	174.97	64.16
6.5	176.19	64.74
6.6	177.38	65.31
6.7	178.53	65.87
6.8	179.64	66.40
6.9	180.73	66.93
7.0	181.78	67.44
7.1	182.81	67.94
7.2	183.80	68.43
7.3	184.77	68.90
7.4	185.71	69.37
7.5	186.63	69.82
7.6	187.52	70.26
7.7	188.39	70.70
7.8	189.24	71.12
7.9	190.07	71.53
8.0	190.87	71.94
9.0	197.94	75.53
10.0	203.60	78.48
11.0	208.22	80.93
12.0	212.08	83.01
13.0	215.34	84.78
14.0	218.13	86.32
15.0	220.56	87.67
16.0	222.68	88.86

Photo 42



GORTON
RACINE, WIS., U.S.A.

REDUCTION FORMULA and SCHEDULES in INCHES for 3-B, 3-L MACHINES

FORM 1461
SCHEDULE OF REDUCTIONS FOR No. 3-B ENGRAVING MACHINE.

REDUCTIONS	DISTANCE IN INCHES TO SET ALL SLIDER BLOCKS FROM GRADUATION 2.
2.0	0.000
2.1	0.381
2.2	0.727
2.3	1.043
2.4	1.333
2.5	1.600
2.6	1.846
2.7	2.074
2.8	2.286
2.9	2.483
3.0	2.667
3.1	2.839
3.2	3.000
3.3	3.152
3.4	3.294
3.5	3.429
3.6	3.556
3.7	3.676
3.8	3.789
3.9	3.897
4.0	4.000
4.1	4.098
4.2	4.190
4.3	4.279
4.4	4.364
4.5	4.444
4.6	4.522
4.7	4.596
4.8	4.667
4.9	4.735
5.0	4.800
5.1	4.863
5.2	4.923
5.3	4.981
5.4	5.037
5.5	5.091
5.6	5.143
5.7	5.193
5.8	5.241
5.9	5.288
6.0	5.333
6.1	5.377
6.2	5.419
6.3	5.460
6.4	5.500
6.5	5.538
6.6	5.576
6.7	5.612
6.8	5.647
6.9	5.681
7.0	5.714
7.1	5.746
7.2	5.778
7.3	5.808
7.4	5.838
7.5	5.867
7.6	5.895
7.7	5.922
7.8	5.949
7.9	5.975
8.0	6.000

FORM 1463
FORMULA FOR OBTAINING SPECIAL REDUCTIONS ON No. 3-B ENGRAVING MACHINE.

EXAMPLE
REDUCTION REQUIRED 2.4

CONSTANT → 16 / REDUCTION → 2.4 = 6.667

CONSTANT → 8.000
− 6.667
1.333"

DISTANCE IN INCHES TO SET ALL FOUR SLIDER BLOCKS FROM GRADUATION 2 FOR 2.4 REDUCTION.

For 3-B, 3-L Area chart. See folded flap at back of book.

FORM 1464
FORMULA FOR OBTAINING SPECIAL REDUCTIONS ON No. 3-L ENGRAVING MACHINE.

EXAMPLE
REDUCTION REQUIRED 2.4

CONSTANT → 24 / REDUCTION → 2.4 = 10.000

CONSTANT → 12.000
− 10.000
2.000"

DISTANCE IN INCHES TO SET ALL FOUR SLIDER BLOCKS FROM GRADUATION 2 FOR 2.4 REDUCTION.

FORM 1462
SCHEDULE OF REDUCTIONS FOR No. 3-L ENGRAVING MACHINE.

REDUCTIONS	DISTANCE IN INCHES TO SET ALL SLIDER BLOCKS FROM GRADUATION 2.
2.0	0.000
2.1	0.571
2.2	1.091
2.3	1.565
2.4	2.000
2.5	2.400
2.6	2.769
2.7	3.111
2.8	3.429
2.9	3.724
3.0	4.000
3.1	4.258
3.2	4.500
3.3	4.727
3.4	4.941
3.5	5.143
3.6	5.333
3.7	5.514
3.8	5.684
3.9	5.846
4.0	6.000
4.1	6.146
4.2	6.286
4.3	6.419
4.4	6.545
4.5	6.667
4.6	6.783
4.7	6.894
4.8	7.000
4.9	7.102
5.0	7.200
5.1	7.294
5.2	7.385
5.3	7.472
5.4	7.556
5.5	7.636
5.6	7.714
5.7	7.789
5.8	7.862
5.9	7.932
6.0	8.000
6.1	8.066
6.2	8.129
6.3	8.190
6.4	8.250
6.5	8.308
6.6	8.364
6.7	8.418
6.8	8.471
6.9	8.522
7.0	8.571
7.1	8.620
7.2	8.667
7.3	8.712
7.4	8.757
7.5	8.800
7.6	8.842
7.7	8.883
7.8	8.923
7.9	8.962
8.0	9.000

Photo 43

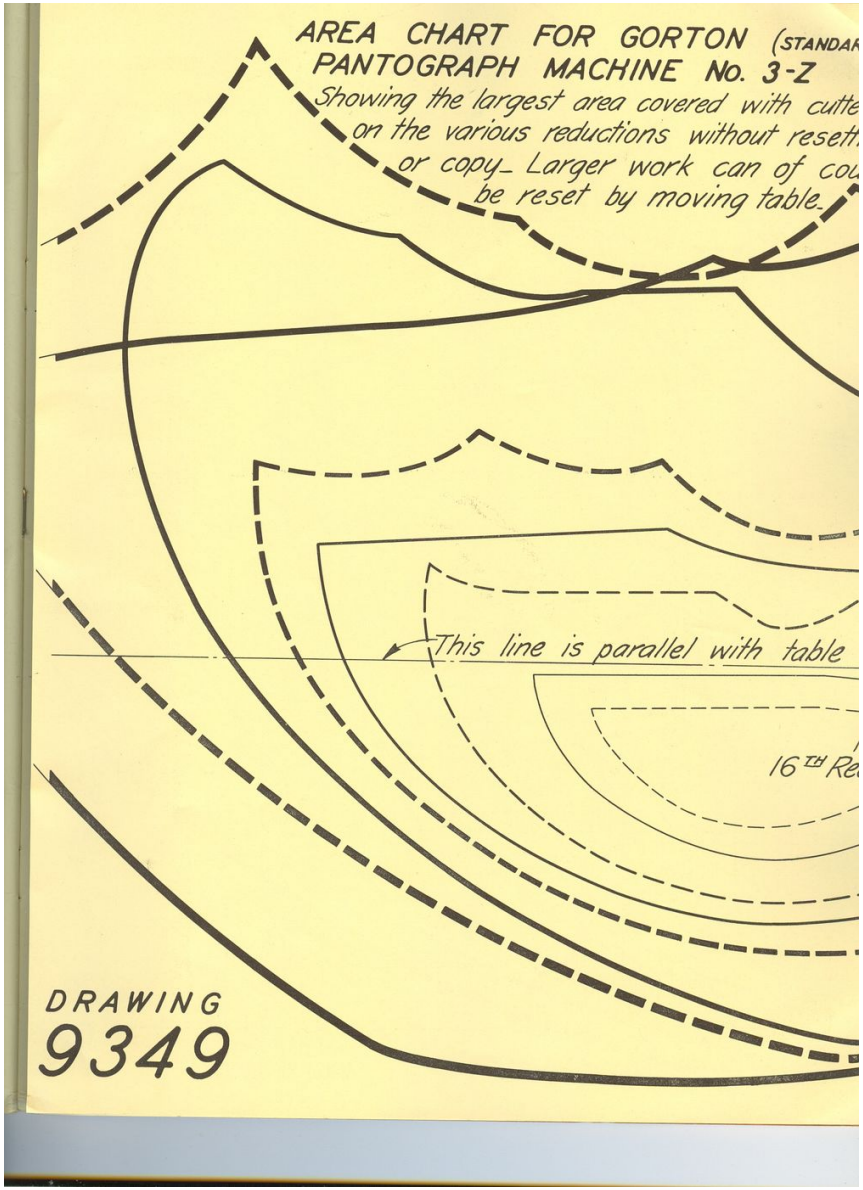

AREA CHART FOR GORTON (STANDAR
PANTOGRAPH MACHINE No. 3-Z
Showing the largest area covered with cutte
on the various reductions without reseti
or copy_ Larger work can of cou
be reset by moving table_
This line is parallel with table
16TH Re
DRAWING
9349

Photo 44

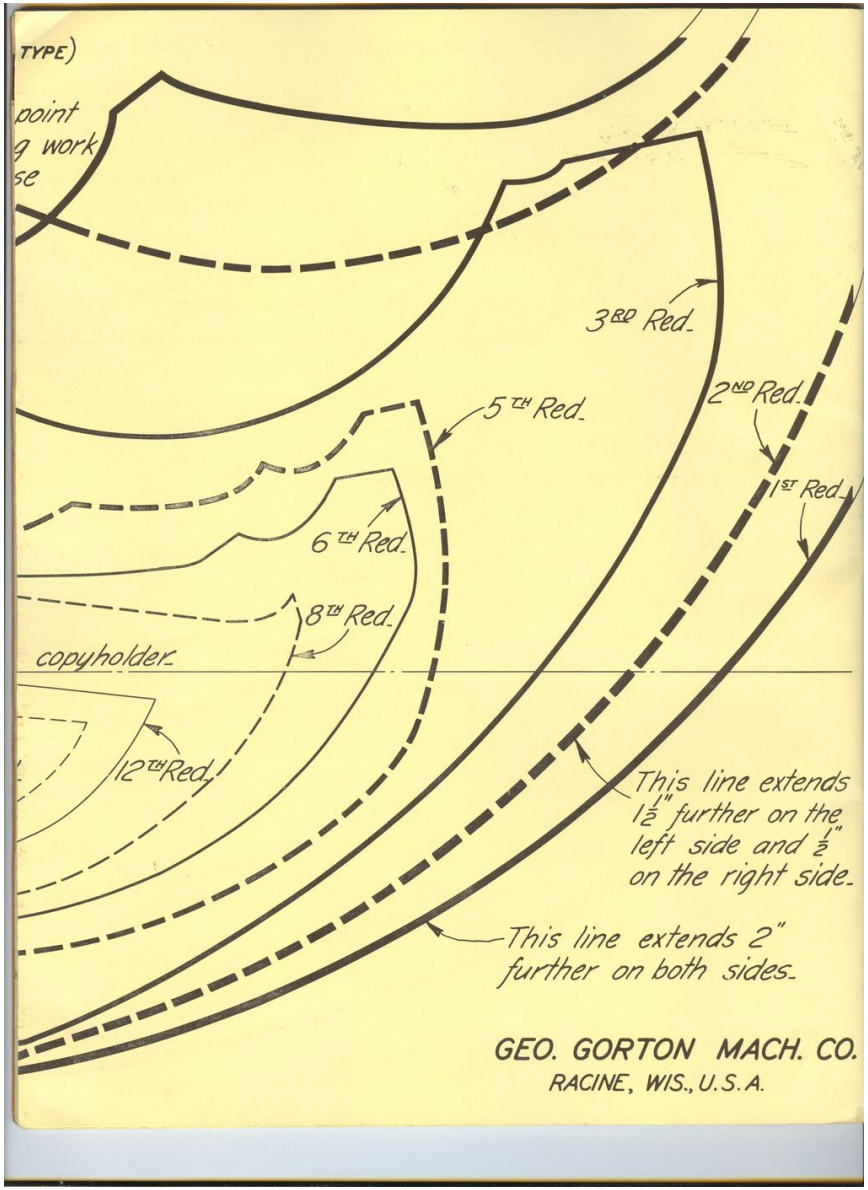

TYPE)
point
g work
se
3RD Red.
2ND Red.
5TH Red.
1ST Red.
6TH Red.
8TH Red.
copyholder.
12TH Red.
This line extends 1½" further on the left side and ½" on the right side.
This line extends 2" further on both sides.
GEO. GORTON MACH. CO.
RACINE, WIS., U.S.A.

Photo 45

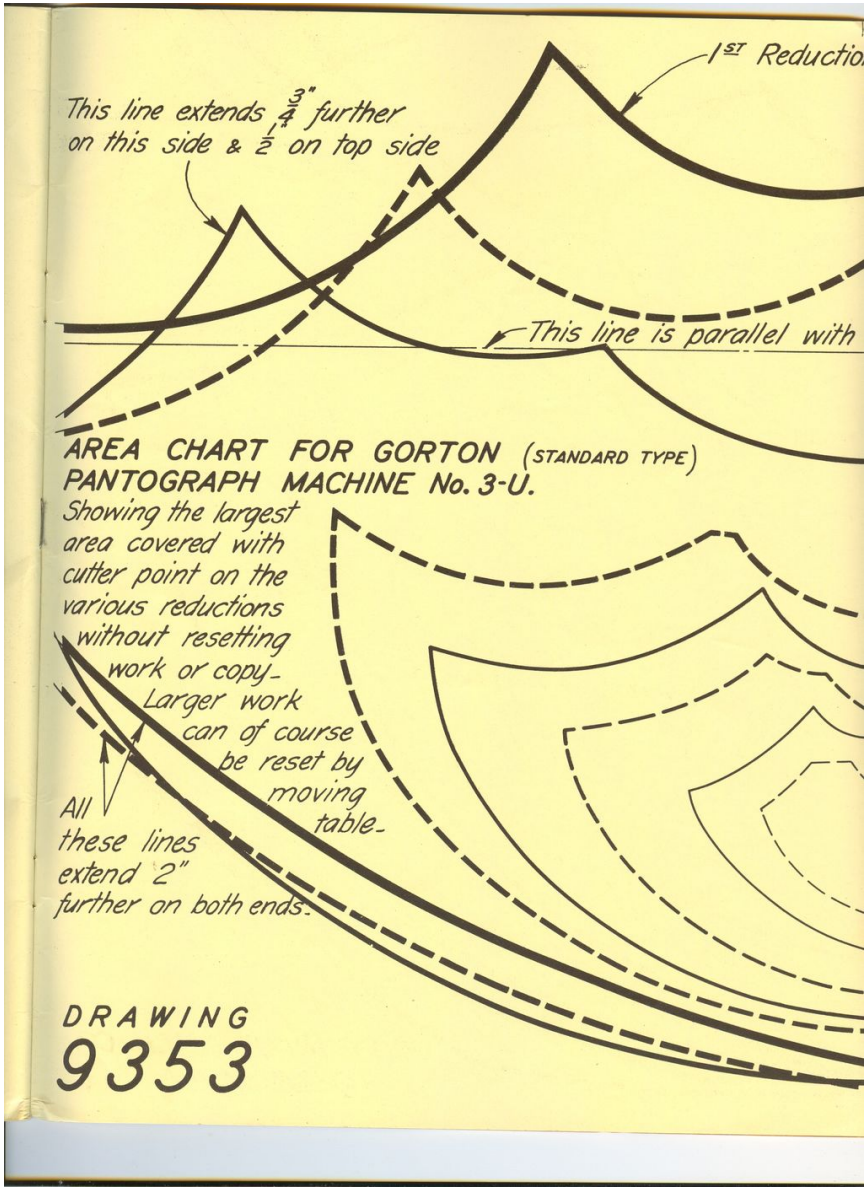

1ST Reductio
This line extends 3/4" further on this side & 1/2 on top side
This line is parallel with
AREA CHART FOR GORTON (STANDARD TYPE) PANTOGRAPH MACHINE No. 3-U.
Showing the largest area covered with cutter point on the various reductions without resetting work or copy-
Larger work can of course be reset by moving table-
All these lines extend 2" further on both ends-
DRAWING
9353

Photo 46

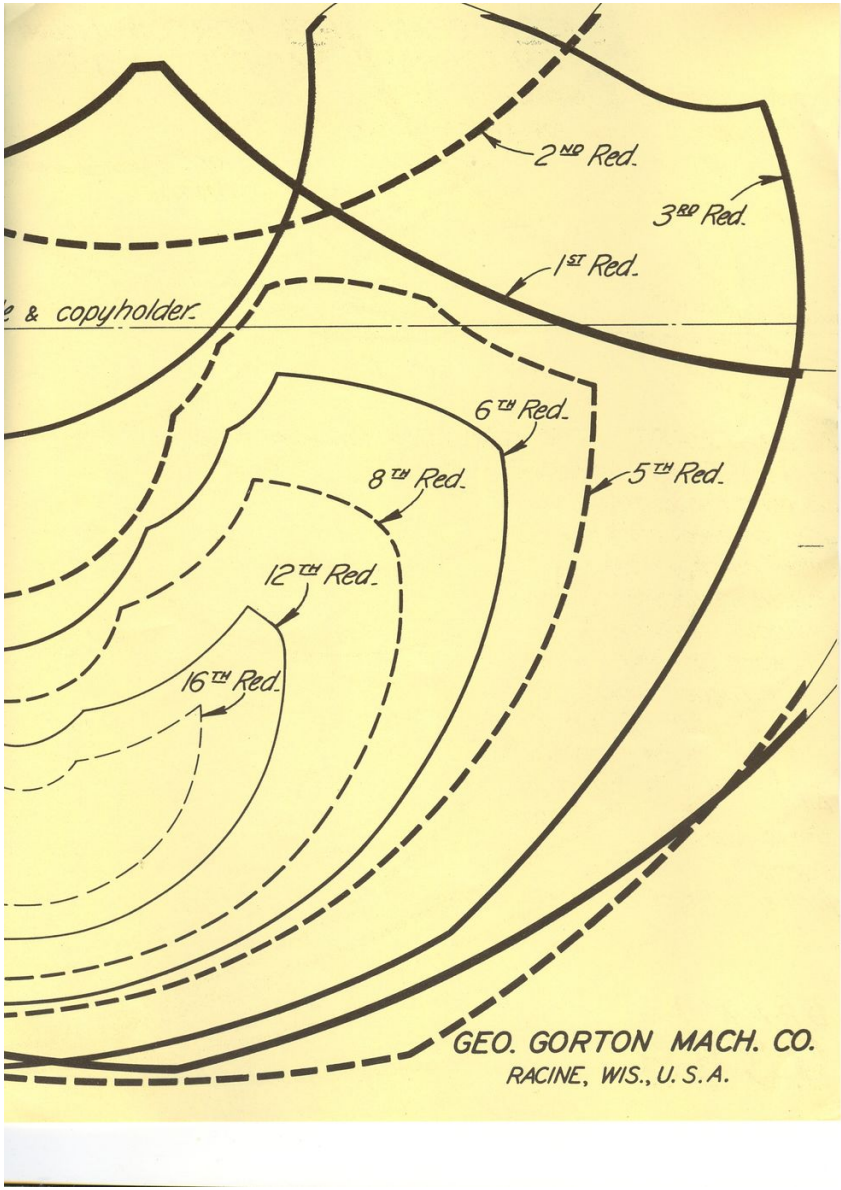

2ND Red.
3RD Red.
1ST Red.
& copyholder.
6TH Red.
5TH Red.
8TH Red.
12TH Red.
16TH Red.
GEO. GORTON MACH. CO.
RACINE, WIS., U. S. A.

Photo 47

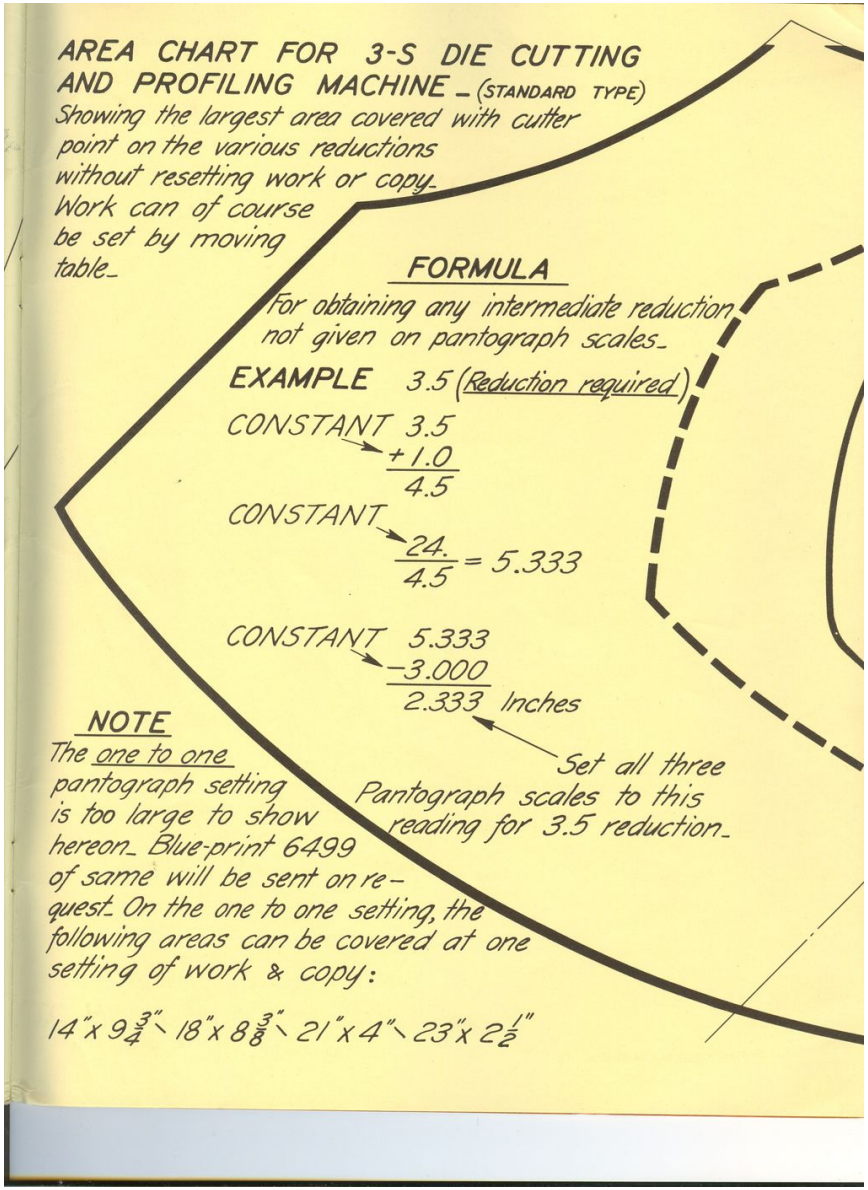

AREA CHART FOR 3-S DIE CUTTING
AND PROFILING MACHINE - (STANDARD TYPE)
Showing the largest area covered with cutter point on the various reductions without resetting work or copy. Work can of course be set by moving table.
FORMULA
For obtaining any intermediate reduction not given on pantograph scales.
EXAMPLE 3.5 (Reduction required)
CONSTANT 3.5
+1.0
4.5
CONSTANT
24. / 4.5 = 5.333
CONSTANT 5.333
-3.000
2.333 Inches
Set all three Pantograph scales to this reading for 3.5 reduction.
NOTE
The one to one pantograph setting is too large to show hereon. Blue-print 6499 of same will be sent on request. On the one to one setting, the following areas can be covered at one setting of work & copy:
14" x 9 3/4" \ 18" x 8 3/8" \ 21" x 4" \ 23" x 2 1/2"

Photo 48

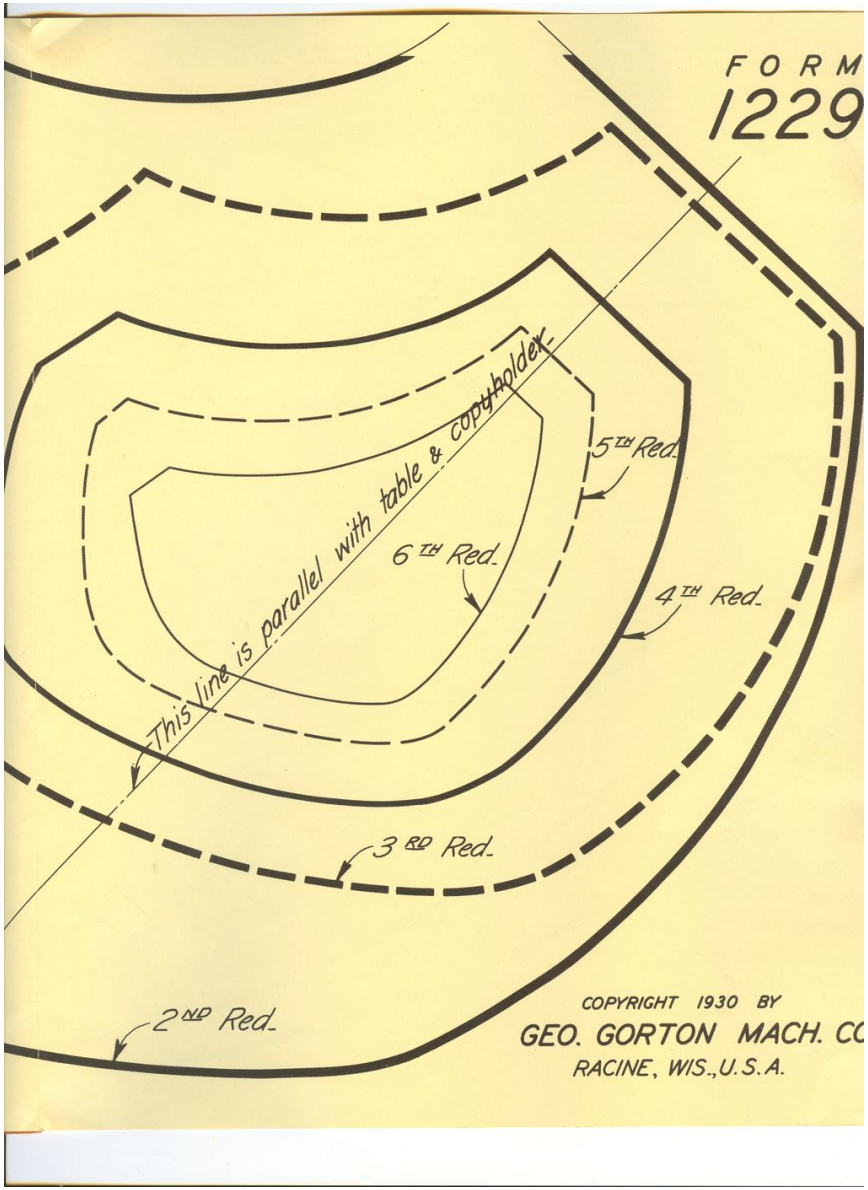

FORM
1229
This line is parallel with table & copyholder.
5TH Red.
6TH Red.
4TH Red.
3RD Red.
2ND Red.
COPYRIGHT 1930 BY
GEO. GORTON MACH. CO
RACINE, WIS., U.S.A.

Photo 49

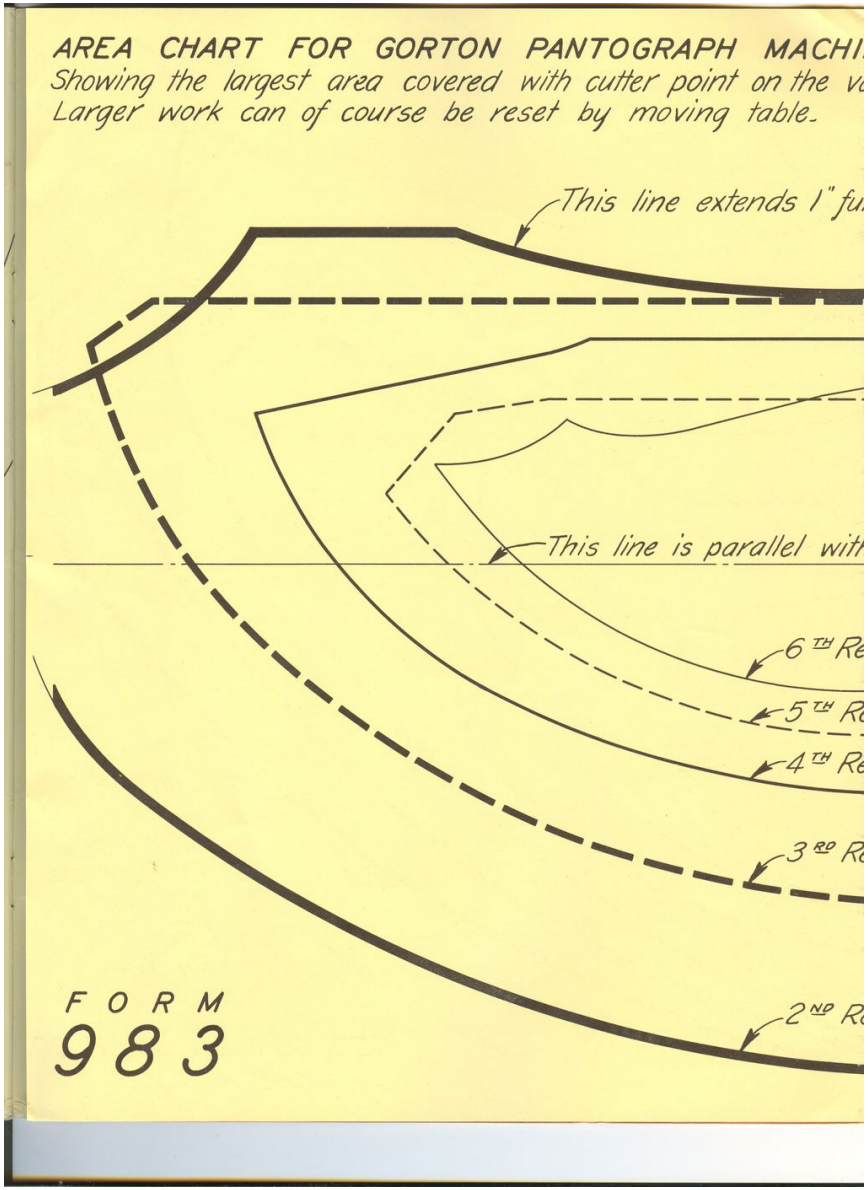

AREA CHART FOR GORTON PANTOGRAPH MACHI
Showing the largest area covered with cutter point on the v
Larger work can of course be reset by moving table.
This line extends 1" fu
This line is parallel wit
6TH Re
5TH R
4TH Re
3RD R
2ND R
FORM
983

Photo 50

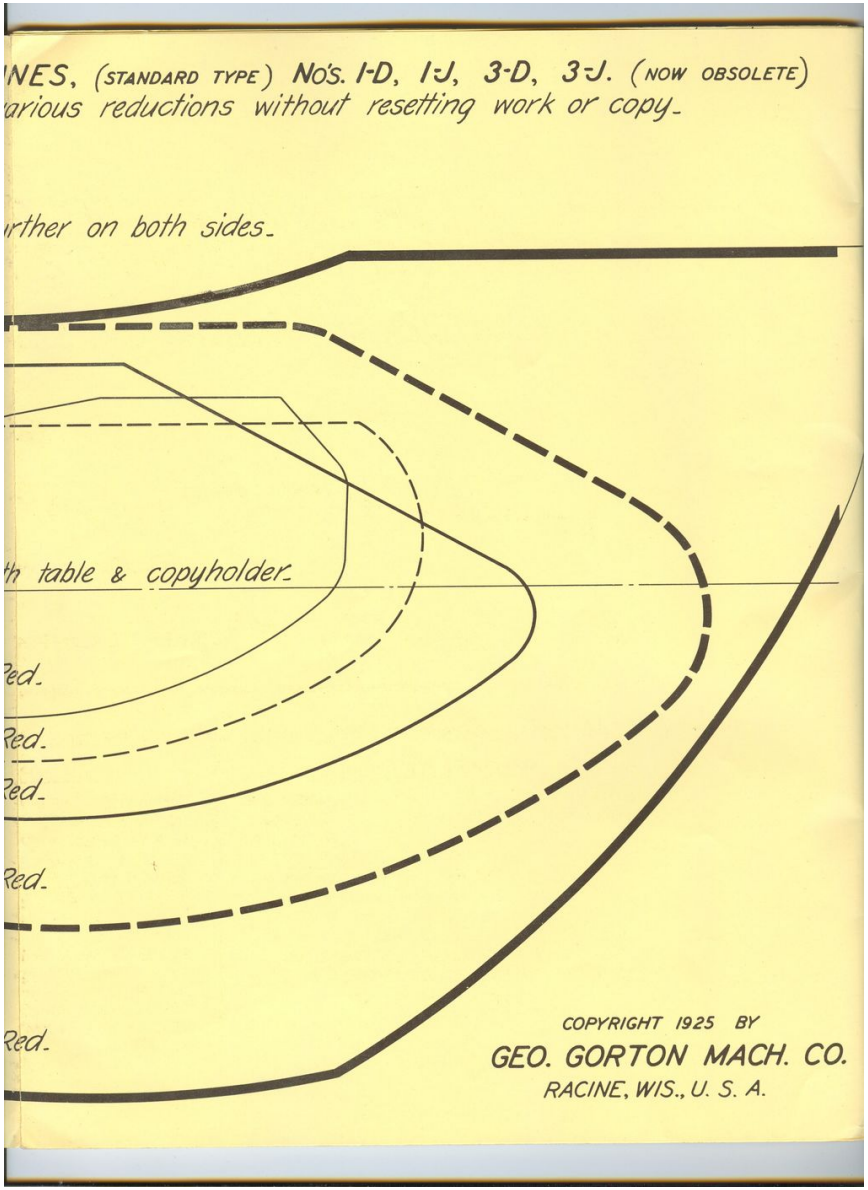
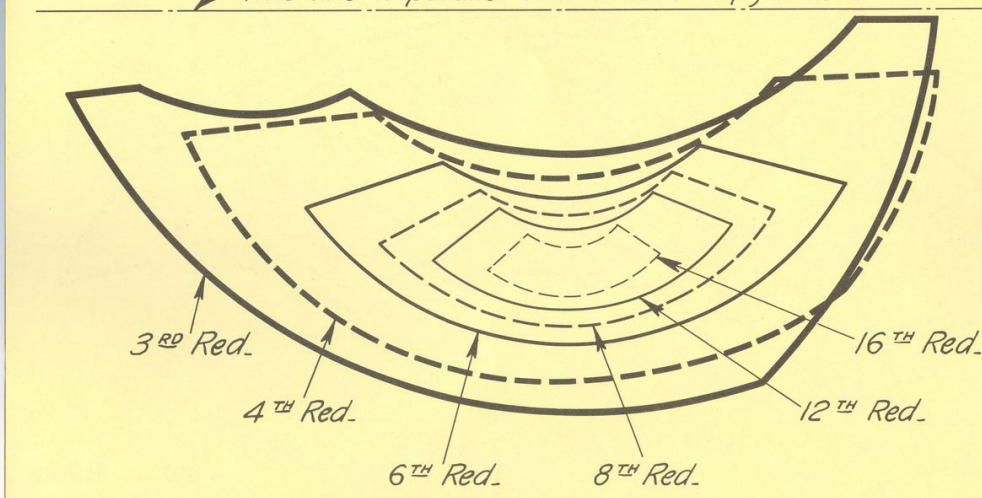

NES, (STANDARD TYPE) NO'S. 1-D, 1-J, 3-D, 3-J. (NOW OBSOLETE)
arious reductions without resetting work or copy.
rther on both sides.
h table & copyholder.
Red.
Red.
Red.
Red.
Red.
COPYRIGHT 1925 BY
GEO. GORTON MACH. CO.
RACINE, WIS., U. S. A.

Photo 51

AREA CHART FOR GORTON PANTOGRAPH MACHINES.
(STANDARD TYPE) No's. 1-A, 1-G, 1-H, 3-A, 3-G, 3-H. (NOW OBSOLETE)
Showing the largest area covered with cutter point on the various reductions without resetting work or copy. Larger work can of course be reset by moving table.



FORM
949

AREA CHART FOR GORTON PANTOGRAPH MACHINES.

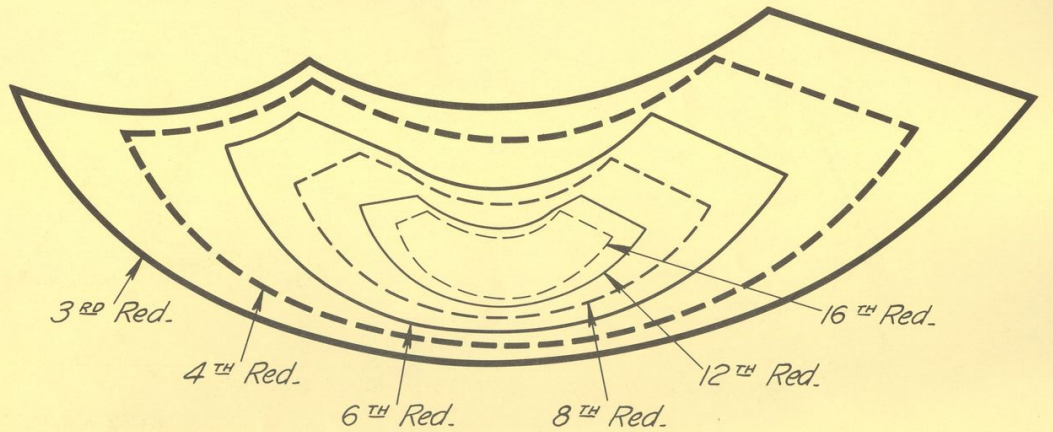
RACINE, WIS., U. S. A.

AREA CHART FOR GORTON PANTOGRAPH MACHINES.

(STANDARD TYPE) NO'S. 3-F, 3-X.

Showing the largest area covered with cutter point on the various reductions without resetting work or copy. Larger work can of course be reset by moving table.

This line is parallel with table & copyholder.



DRAWING
9358

GEO. GORTON MACH. CO.
RACINE, WIS., U. S. A.

Photo 52

Photo 53

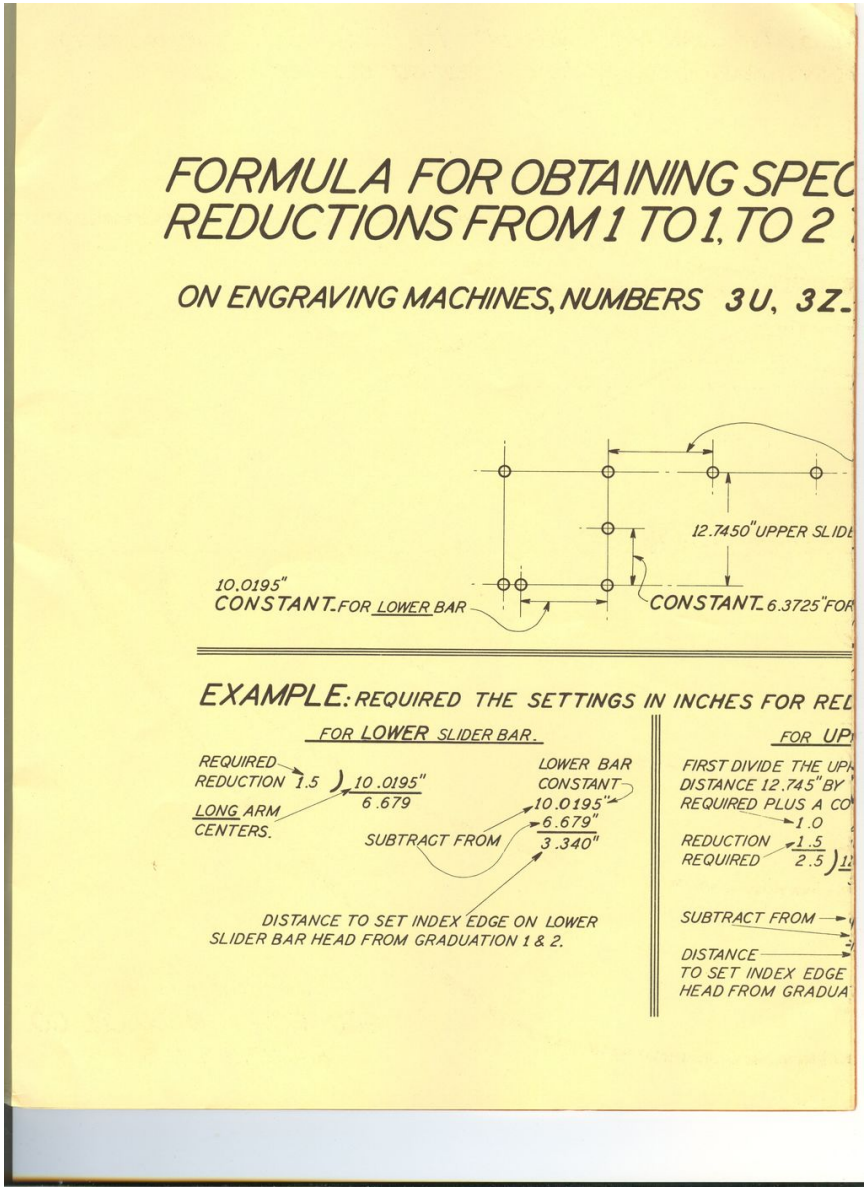
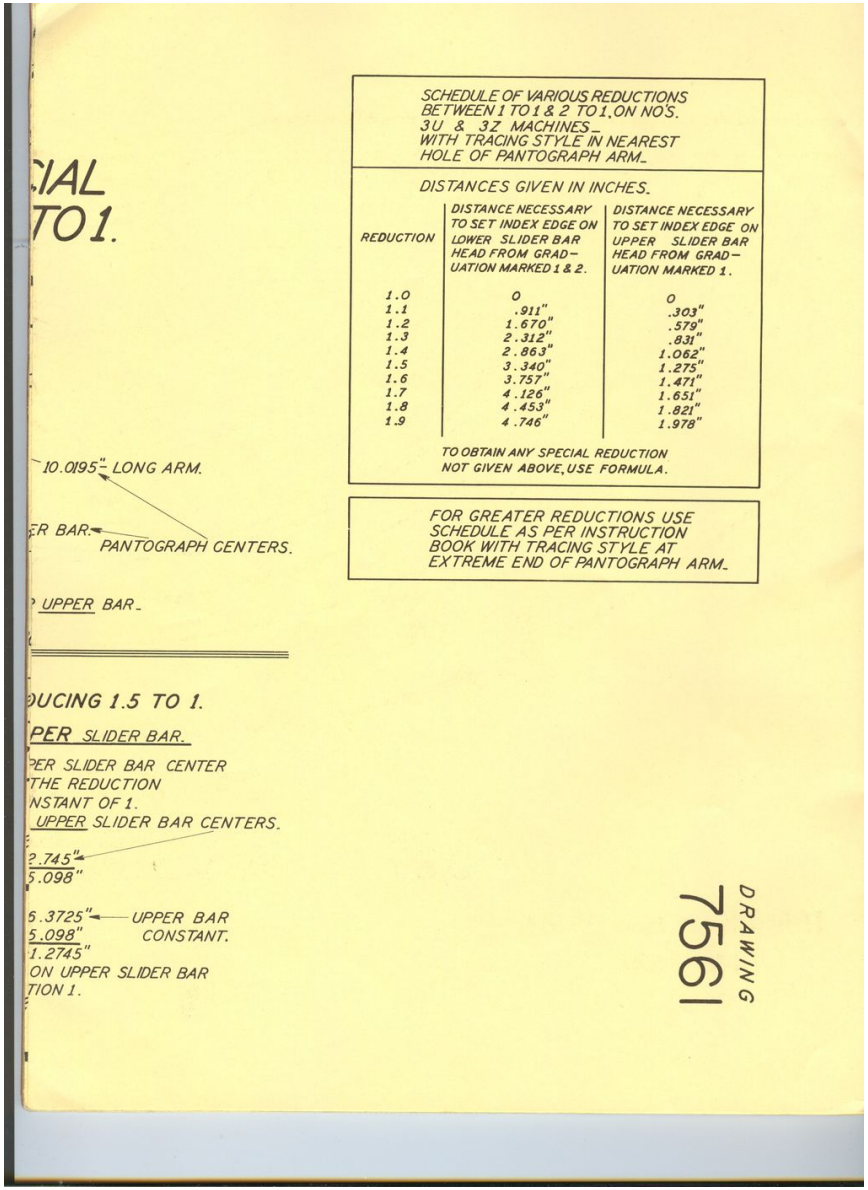

FORMULA FOR OBTAINING SPEC
REDUCTIONS FROM 1 TO 1, TO 2
ON ENGRAVING MACHINES, NUMBERS 3U, 3Z-
12.7450" UPPER SLIDE
10.0195"
CONSTANT FOR LOWER BAR
CONSTANT 6.3725" FOR
EXAMPLE: REQUIRED THE SETTINGS IN INCHES FOR REL
FOR LOWER SLIDER BAR.
REQUIRED REDUCTION 1.5
LONG ARM CENTERS.
10.0195"
6.679
LOWER BAR CONSTANT
10.0195"
SUBTRACT FROM
6.679"
3.340"
DISTANCE TO SET INDEX EDGE ON LOWER SLIDER BAR HEAD FROM GRADUATION 1 & 2.
FOR UP
FIRST DIVIDE THE UP
DISTANCE 12.745" BY
REQUIRED PLUS A CO
1.0
REDUCTION REQUIRED
1.5
2.5
SUBTRACT FROM
DISTANCE
TO SET INDEX EDGE
HEAD FROM GRADUA

Photo 54



CIAL
TO 1.

10.0195" LONG ARM.

ER BAR. PANTOGRAPH CENTERS.

UPPER BAR.

DUCING 1.5 TO 1.

PER SLIDER BAR.

PER SLIDER BAR CENTER
THE REDUCTION
NSTANT OF 1.
UPPER SLIDER BAR CENTERS.

2.745"
5.098"

5.3725" UPPER BAR
5.098" CONSTANT.
1.2745"
ON UPPER SLIDER BAR
TION 1.

SCHEDULE OF VARIOUS REDUCTIONS BETWEEN 1 TO 1 & 2 TO 1. ON NO'S. 3U & 3Z MACHINES. WITH TRACING STYLE IN NEAREST HOLE OF PANTOGRAPH ARM.

DISTANCES GIVEN IN INCHES.

REDUCTION	DISTANCE NECESSARY TO SET INDEX EDGE ON LOWER SLIDER BAR HEAD FROM GRADUATION MARKED 1 & 2.	DISTANCE NECESSARY TO SET INDEX EDGE ON UPPER SLIDER BAR HEAD FROM GRADUATION MARKED 1.
1.0	0	0
1.1	.911"	.303"
1.2	1.670"	.579"
1.3	2.312"	.831"
1.4	2.863"	1.062"
1.5	3.340"	1.275"
1.6	3.757"	1.471"
1.7	4.126"	1.651"
1.8	4.453"	1.821"
1.9	4.746"	1.978"

TO OBTAIN ANY SPECIAL REDUCTION NOT GIVEN ABOVE, USE FORMULA.

FOR GREATER REDUCTIONS USE SCHEDULE AS PER INSTRUCTION BOOK WITH TRACING STYLE AT EXTREME END OF PANTOGRAPH ARM.

DRAWING 1961

Photo 55

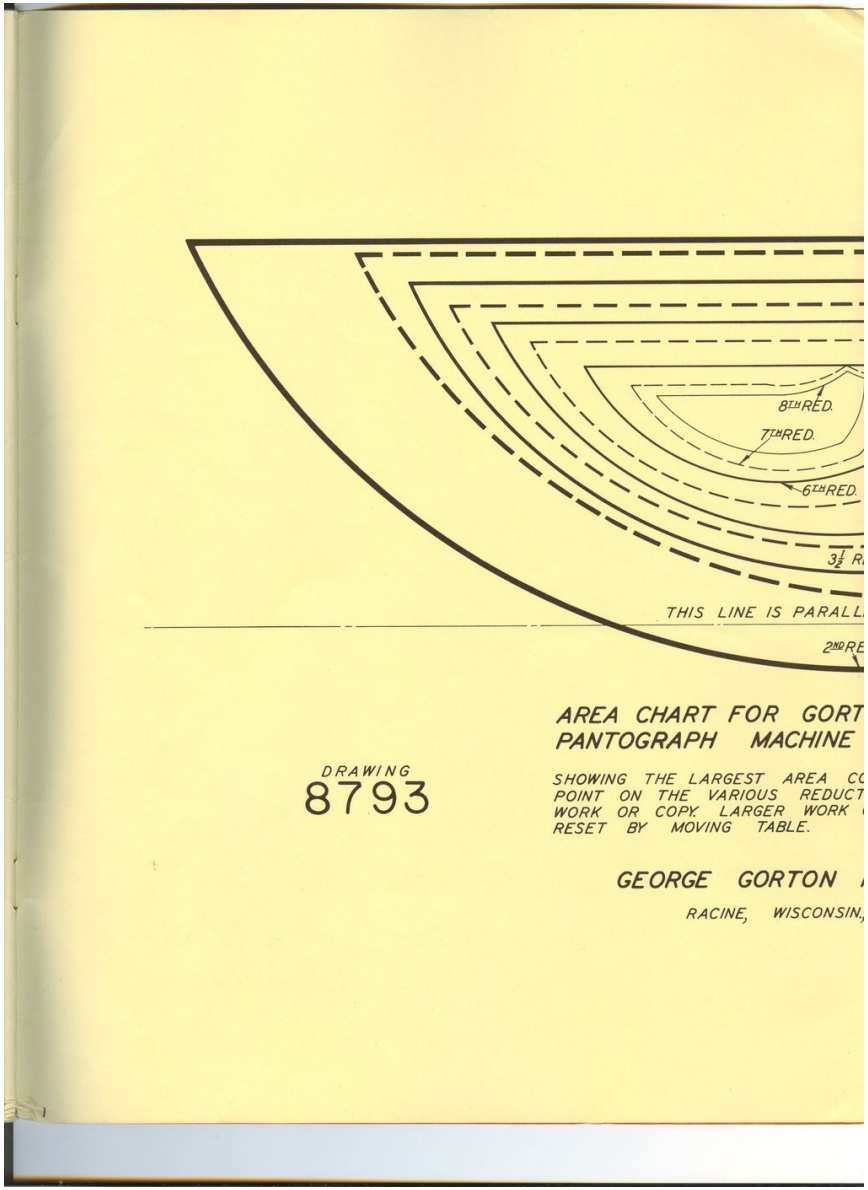

8TH RED.
7TH RED.
6TH RED.
THIS LINE IS PARALL
2ND RE
AREA CHART FOR GORT
PANTOGRAPH MACHINE
DRAWING
8793
SHOWING THE LARGEST AREA C
POINT ON THE VARIOUS REDUCT
WORK OR COPY. LARGER WORK
RESET BY MOVING TABLE.
GEORGE GORTON
RACINE, WISCONSIN,

Photo 56

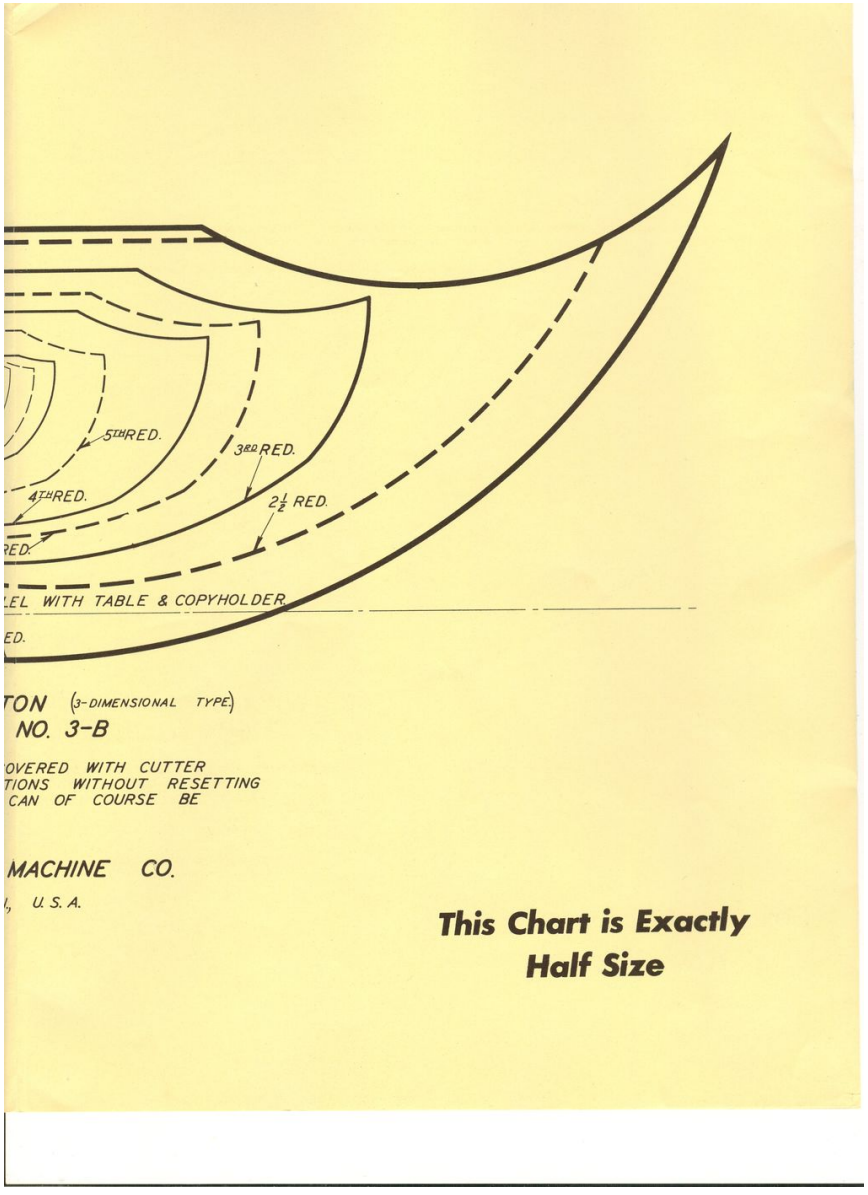

5TH RED.
3RD RED.
4TH RED.
2½ RED.
EL WITH TABLE & COPYHOLDER
ED.
TON (3-DIMENSIONAL TYPE)
NO. 3-B
OVERED WITH CUTTER
TIONS WITHOUT RESETTING
CAN OF COURSE BE
MACHINE CO.
U. S. A.
This Chart is Exactly
Half Size

Photo 57

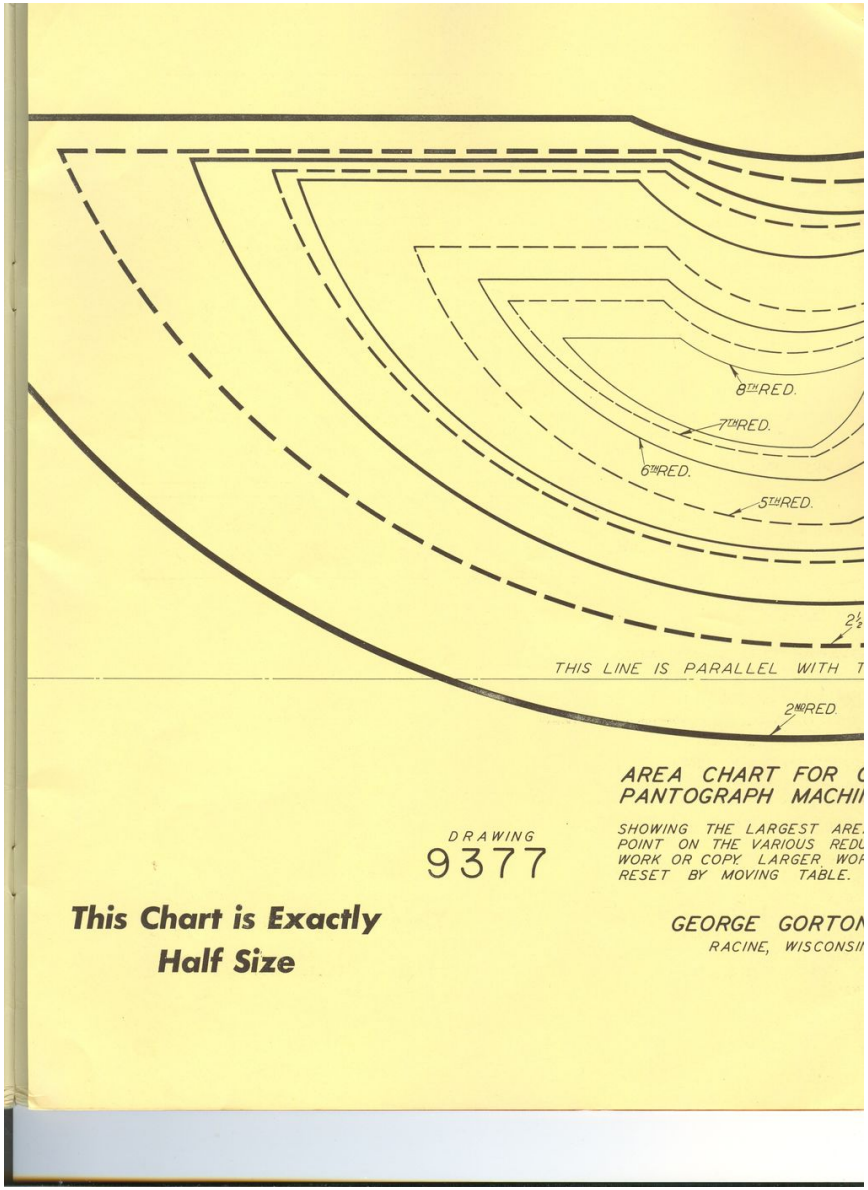

8TH RED.
7TH RED.
6TH RED.
5TH RED.
THIS LINE IS PARALLEL WITH
2ND RED.
AREA CHART FOR
PANTOGRAPH MACHI
SHOWING THE LARGEST ARE
POINT ON THE VARIOUS REDU
WORK OR COPY. LARGER WOR
RESET BY MOVING TABLE.
DRAWING
9377
This Chart is Exactly
Half Size
GEORGE GORTON
RACINE, WISCONSI

Photo 58

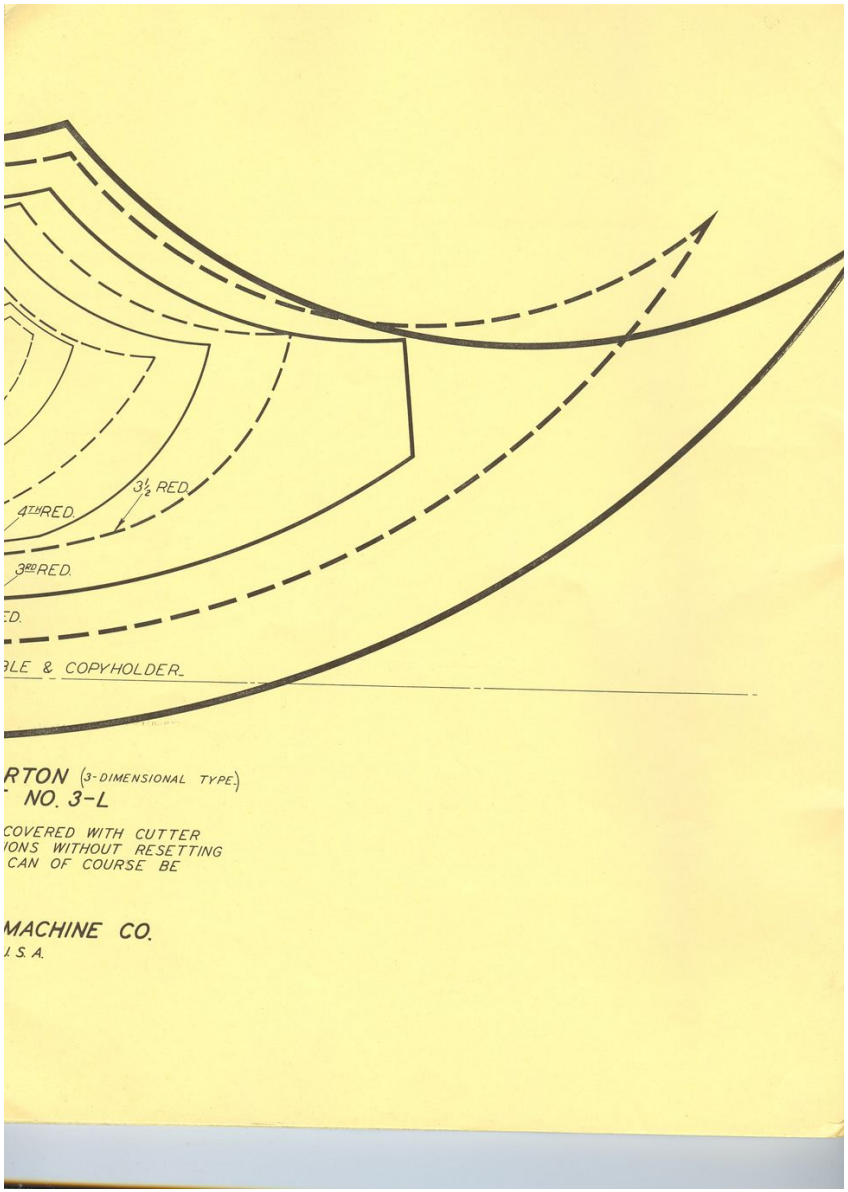
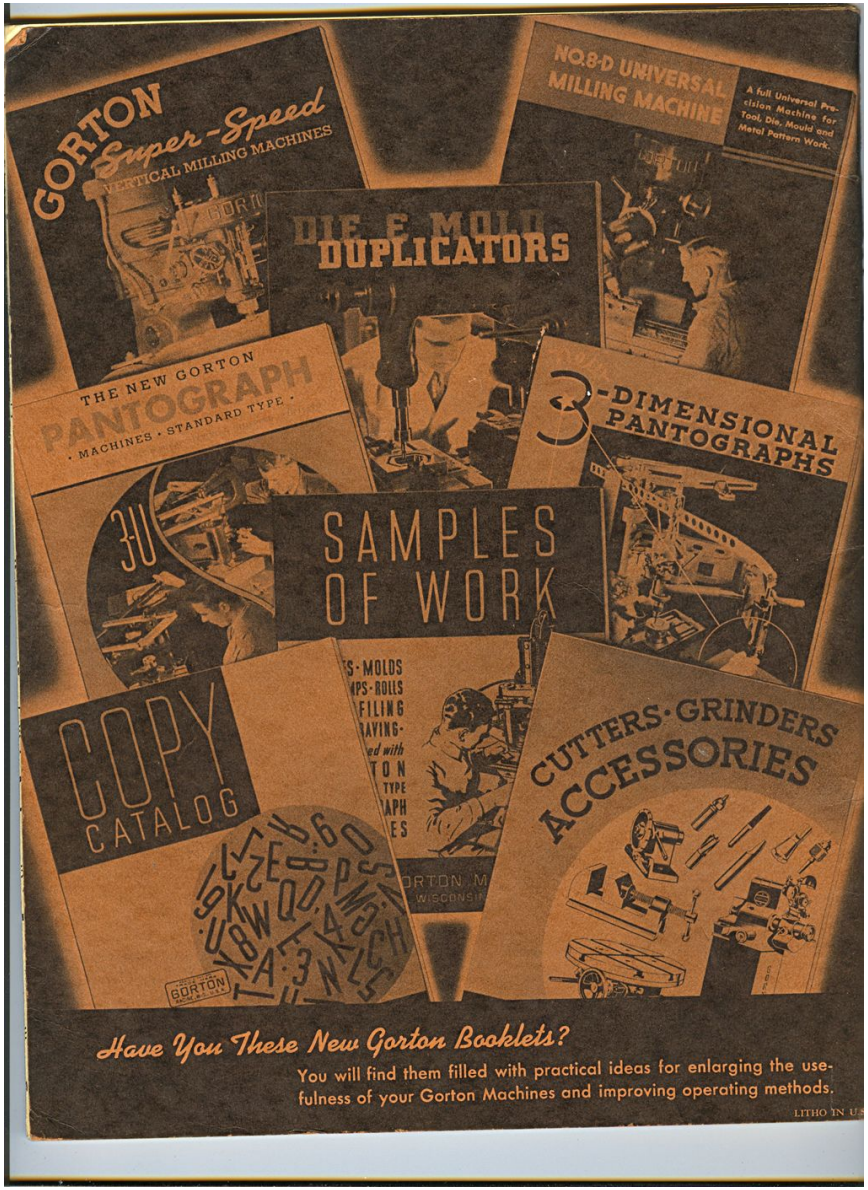

4TH RED.
3½ RED.
3RD RED.
ED.
BLE & COPYHOLDER.
RTON (3-DIMENSIONAL TYPE)
NO. 3-L
COVERED WITH CUTTER
IONS WITHOUT RESETTING
CAN OF COURSE BE
MACHINE CO.
I. S. A.

Photo 59


GORTON
Super-Speed
VERTICAL MILLING MACHINES
NO. 8-D UNIVERSAL MILLING MACHINE
A full Universal Precision Machine for Tool, Die, Mould and Metal Pattern Work.
DUPLICATORS
THE NEW GORTON
PANTOGRAPH
MACHINES · STANDARD TYPE
3-DIMENSIONAL PANTOGRAPHS
SAMPLES OF WORK
COPY CATALOG
CUTTERS · GRINDERS
ACCESSORIES
GORTON
Have You These New Gorton Booklets?
You will find them filled with practical ideas for enlarging the usefulness of your Gorton Machines and improving operating methods.