Photo 1

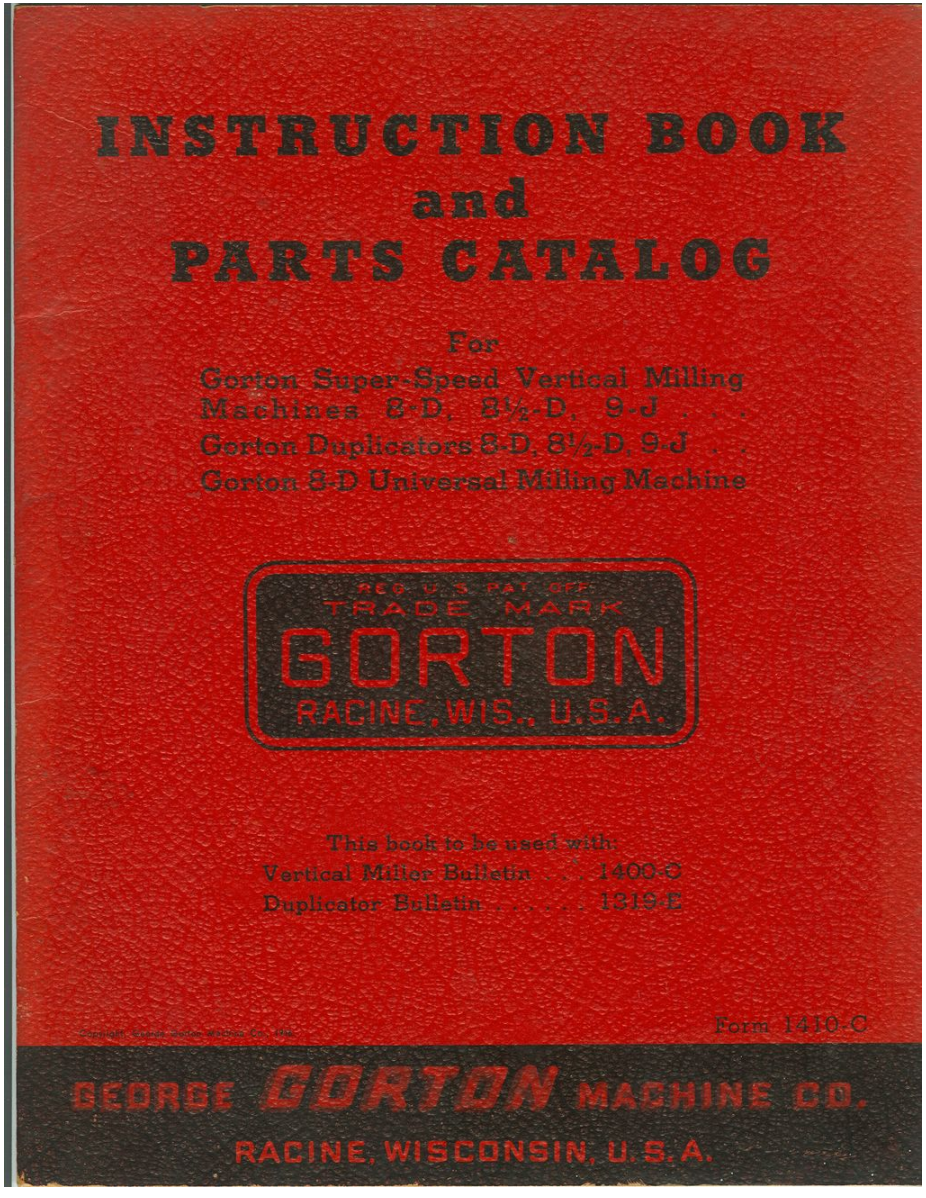
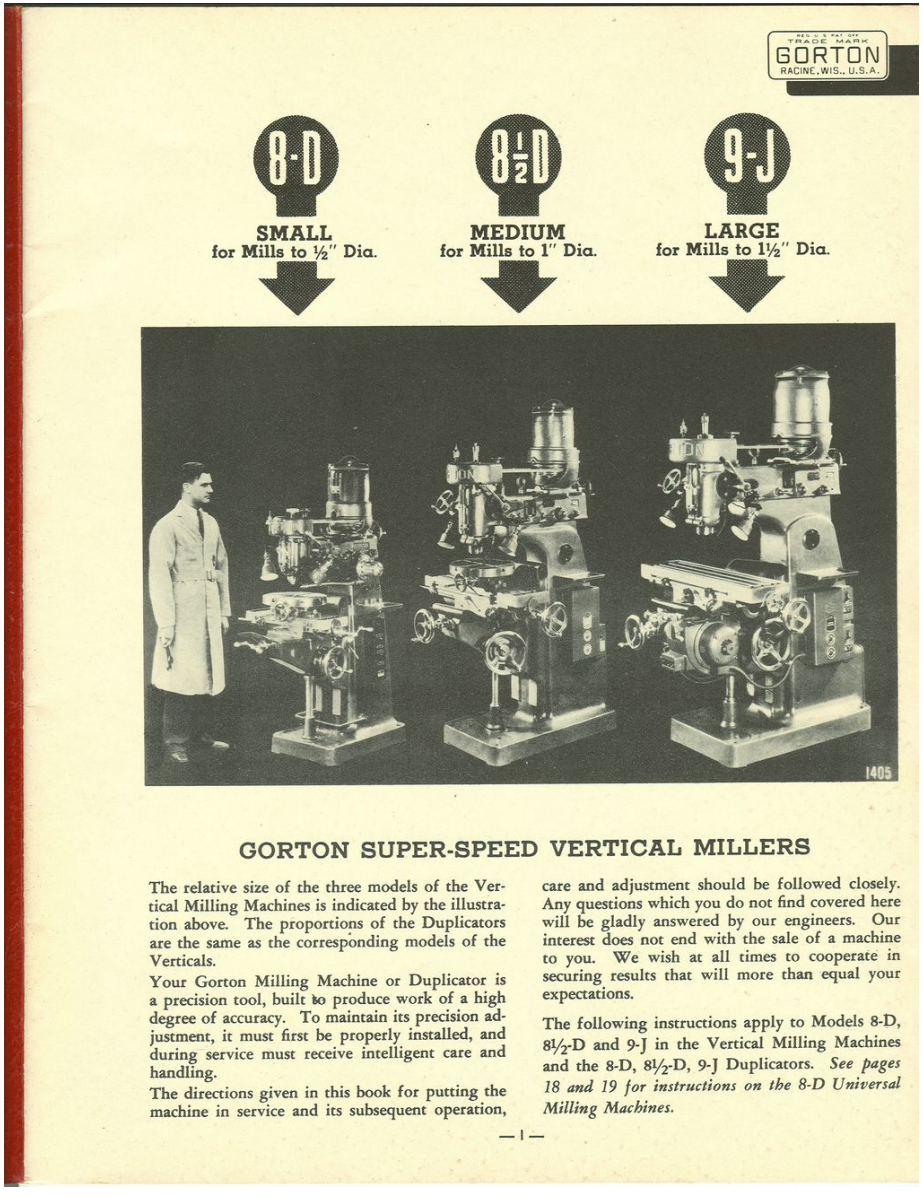

INSTRUCTION BOOK
and
PARTS CATALOG
For
Gorton Super-Speed Vertical Milling Machines 8-D, 8½-D, 9-J . . .
Gorton Duplicators 8-D, 8½-D, 9-J . . .
Gorton 8-D Universal Milling Machine
REG. U.S. PAT. OFF.
TRADE MARK
GORTON
RACINE, WIS., U.S.A.
This book to be used with:
Vertical Miller Bulletin . . . 1400-C
Duplicator Bulletin 1319-E
Form 1410-C
GEORGE GORTON MACHINE CO.
RACINE, WISCONSIN, U.S.A.

Photo 2



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

8-D
SMALL
for Mills to ½" Dia.

8½D
MEDIUM
for Mills to 1" Dia.

9-J
LARGE
for Mills to 1½" Dia.

1405

GORTON SUPER-SPEED VERTICAL MILLERS

The relative size of the three models of the Vertical Milling Machines is indicated by the illustration above. The proportions of the Duplicators are the same as the corresponding models of the Verticals.

Your Gorton Milling Machine or Duplicator is a precision tool, built to produce work of a high degree of accuracy. To maintain its precision adjustment, it must first be properly installed, and during service must receive intelligent care and handling.

The directions given in this book for putting the machine in service and its subsequent operation, care and adjustment should be followed closely. Any questions which you do not find covered here will be gladly answered by our engineers. Our interest does not end with the sale of a machine to you. We wish at all times to cooperate in securing results that will more than equal your expectations.

The following instructions apply to Models 8-D, 8½-D and 9-J in the Vertical Milling Machines and the 8-D, 8½-D, 9-J Duplicators. *See pages 18 and 19 for instructions on the 8-D Universal Milling Machines.*

Photo 3

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

UNPACKING and ERECTING

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.

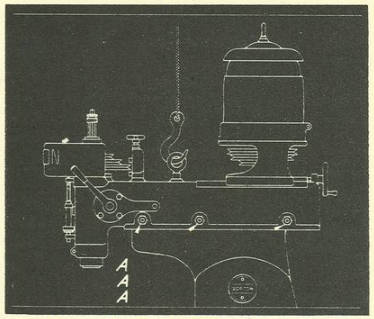


Fig. 1—Lifting Machine with Eye-bolt in Sliding Head

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.

3. LOCATING THE MACHINE

All models may be easily handled by hoists where available. When a hoist is used, a) remove the cutter spindle drive belt; b) Put head in normal operating position as above. (If the head is too far extended the machine will not balance properly when lifted.) c) *Caution:* Make sure the head is securely clamped to column with nuts AAA above. Now insert hook in eye-bolt as shown above.

4. LEVELING

After the machine has been set in place it should be levelled by means of a small machinist level placed on the machine table. This is particularly important on all Duplicators. 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. PUTTING INTO SERVICE

a) Remove the glass sight feed oil cup located at left side of spindle pulley housing near top of spindle. Fill this hole with oil, using only the grade of oil specified on page 3, until the oil drips slightly at lower end of spindle. This fills up oil line so that when oil cup is replaced, oil will immediately feed to the bearings. Now, set the oil cup to feed as recommended on page 3. Be extremely careful not to drop any dirt or grit into the hole while oil cup is removed, and make sure that the oil, and container from which it is poured, are perfectly clean. The slightest dirt can cause trouble as the precision ball bearings on which the spindle runs are so closely fitted. If a slight amount of dirt should get into the oil *after* the oil cup has been replaced, it will do no harm, as the cup has a felt filter.

b) The gear boxes of machines equipped with power table or spindle feeds have been drained before shipment. Before starting refill, using the grade of oil specified on page 3. All power table feed boxes have a large hinge lid oiler at rear of box, with glass inspection hole. Fill with oil until visible in the glass. Power spindle feed boxes are filled from the top, by removing the large slotted screw marked "oil" and filling to level of the knurled inspection hole screw at side of box.

c) Release cutter spindle brake from pulley before starting the spindle motor, otherwise you may burn out fuses or fusible links in starting box.

d) *Caution:* Make sure that table and spindle clamps are loose before starting table or spindle power feed (if machine is so equipped), otherwise you may burn out fuses or fusible links in starting box.

Photo 4

LUBRICATION
FOR 8-D, 8½-D, 9-J VERTICAL MILLERS and DUPLICATORS

GENERAL — The machine should be thoroughly cleaned at least once a week — and the scraped ways wiped clean, and oiled. The Gargoyle lubricants recommended below are manufactured by Socony-Vacuum Oil Company, Inc., and are universally obtainable in all parts of the world.

CUTTER SPINDLE AND DRIVE PULLEY

All bearings of the cutter spindle and drive pulley are lubricated by one sight feed oil cup located at top of drive pulley housing and marked by the symbol ✣ on the lubrication chart. Use a spindle oil having approximately 125 seconds S.U. Viscosity at 100 F., such as Gargoyle Vacuoline Oil C. A good grade of medium machine oil, such as recommended for other bearings on the machine, may be used if spindle oil is not available but will not give as good results as the latter due to the high speeds at which the cutter spindle turns.

The sight feed cup should be kept well supplied with oil and refilled at least once weekly. Before starting up it is important that the shut-off at the top of the cup be turned up vertically to permit oil to flow, otherwise the spindle will receive no lubrication. The feed may be stopped when machine is not in use by turning the shut-off to one side. The cup should be set to feed from one to three drops per hour (no more) as service requires. The knurled nut at base of shut-off provides adjustment for oil flow. If a change is made in grade of oil used, the cup may need resetting. Too fast a feed will cause oil leakage down onto the work, which is sometimes annoying.

SLIDING HEAD ASSEMBLY

All points on this assembly, except cutter spindle, are indicated by red dots ● on the chart, and should be lubricated once weekly through hinge lid oilers using an ordinary oil can. A good grade of medium machine oil having a viscosity of 275 to 300 seconds S.U. at 100 F., such as Gargoyle Vactra Oil Heavy Medium X is recommended for this purpose. Once a week, wipe clean the spindle splines above drive pulley and apply a few drops of oil. Do the same with micrometer spindle depth stop and its threads. If the sliding head is extended see that any accumulation of dirt is wiped from the scraped column way, also wipe column way with an oily rag, before moving head back to normal position.

The oil level in the cutter spindle feed box (hand or power) should be checked about once every six months by removing the inspection plug at the rear of the hand feed box and the knurled oil hole screw on the power feed box. Keep boxes filled to level of these holes using a heavy viscous lubricant such as Gargoyle Cylinder Oil 600W. On machines having power feed, similar attention should be given the worm gears of the geared head motor using the same type of lubricant. See points marked ● for filling plugs on both the motor and feed box. At intervals of one to two years it is good practice to drain these compartments of old lubricant, flush and refill with new oil. This will act to remove any water or impurities which may have gained entrance.

TABLE, SADDLE AND KNEE ASSEMBLY

Once a week lubricate all hinge lid oilers with medium machine oil the same as recommended for "Sliding Head Assembly". These points are shown by red dots ● on the chart. Once weekly, with knee all the way up, raise elevating screw cover and squirt a few drops of oil on screw, as high as possible. Also saturate the felt wiper on knee with oil. The table and saddle screws should be oiled daily, by running out the table to extreme positions so as to get at screws. Lubricate through oil holes at front and back of saddle, taking care to replace plugs. Do the same with threaded screws in table top marked "Oil".

In machines having power feeds to table, keep the gear box filled to sight gauge level at back of box with medium machine oil the same as recommended for general lubrication of other points. The gauge which has a hinge lid for filling is designated by symbol ✣ . It will prove beneficial to drain the gear box about once yearly, flush out impurities and refill with fresh oil.

ELECTRIC MOTORS

The motor serving to drive the spindle, and those to operate the table, spindle feed or coolant pump where used, are equipped with grease lubricated ball bearings. These are indicated by the symbol □ on the chart. The grease reservoirs should be filled about every 1000 hours of operation using a high grade ball bearing grease such as Gargoyle Grease BRB No. 2. Never use ordinary cup grease which will not stand up satisfactorily in motors. To lubricate bearings unscrew slotted brass plug and introduce grease preferably with a low pressure gun. Apply the grease sparingly and never force it into bearings under heavy pressure as this may injure the seals and cause leakage. Should excess lubricant lodge on internal parts of the motor it may seriously impair efficiency. Always make certain the brass plugs are properly replaced. For further instructions see Instruction Book or Tag issued by motor manufacturer and furnished with the machine.

Photo 5

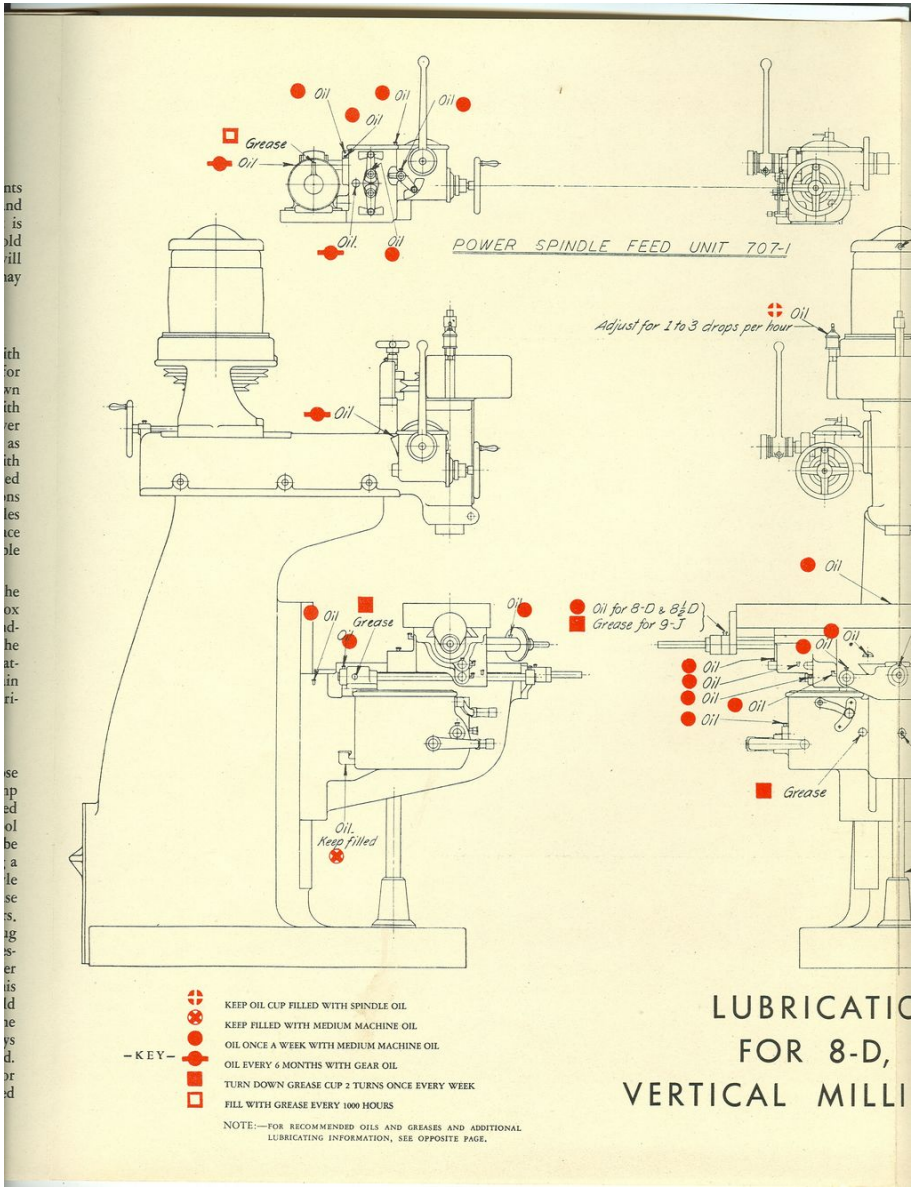

Oil
Grease
POWER SPINDLE FEED UNIT 707-1
Adjust for 1 to 3 drops per hour
Oil for 8-D & 8½D
Grease for 9-J
Keep filled
KEEP OIL CUP FILLED WITH SPINDLE OIL
KEEP FILLED WITH MEDIUM MACHINE OIL
OIL ONCE A WEEK WITH MEDIUM MACHINE OIL
OIL EVERY 6 MONTHS WITH GEAR OIL
TURN DOWN GREASE CUP 2 TURNS ONCE EVERY WEEK
FILL WITH GREASE EVERY 1000 HOURS
NOTE:—FOR RECOMMENDED OILS AND GREASES AND ADDITIONAL LUBRICATING INFORMATION, SEE OPPOSITE PAGE.
LUBRICATIO
FOR 8-D,
VERTICAL MILLI

Photo 6

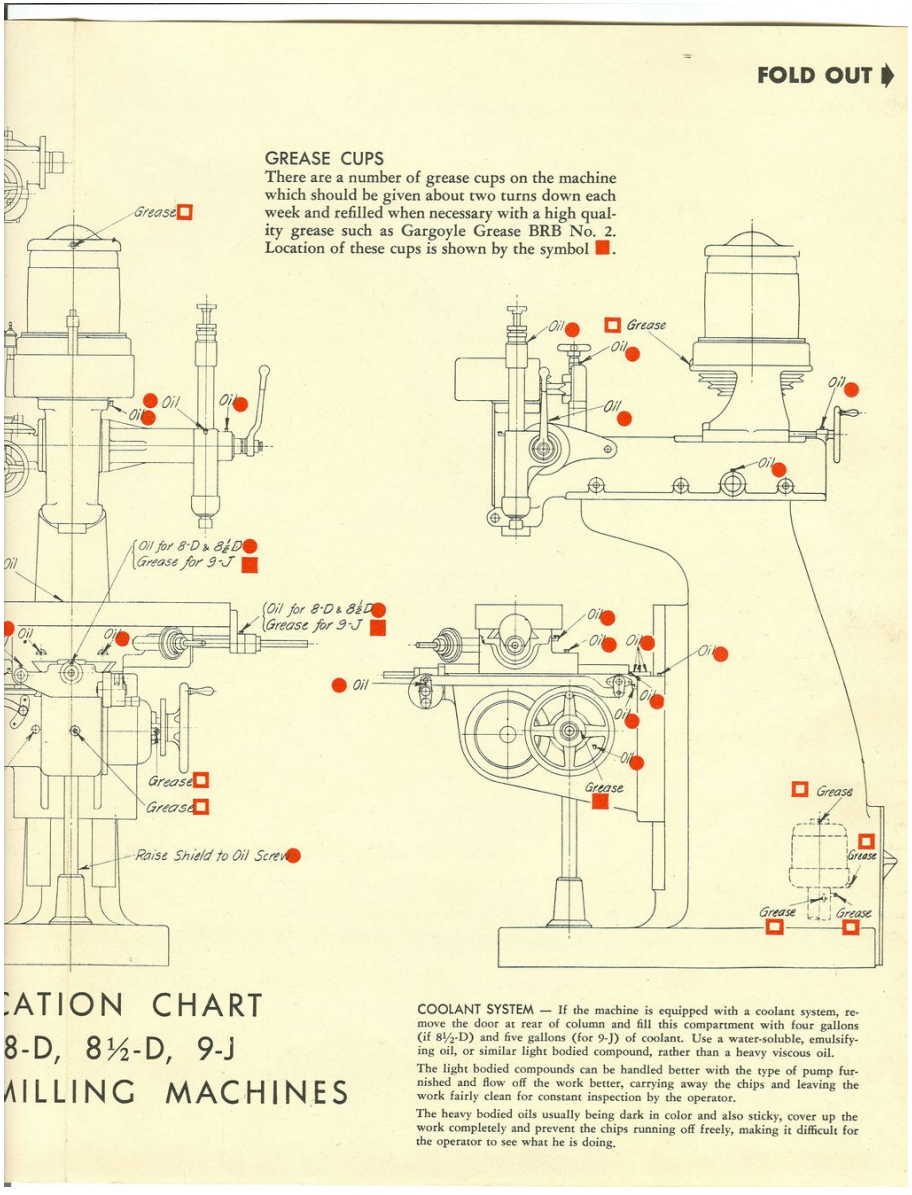
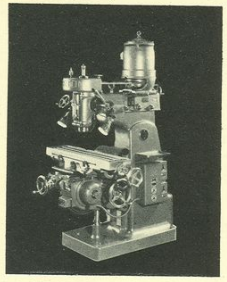
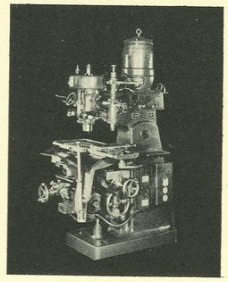

FOLD OUT
GREASE CUPS
There are a number of grease cups on the machine which should be given about two turns down each week and refilled when necessary with a high quality grease such as Gargoyle Grease BRB No. 2. Location of these cups is shown by the symbol ■.
Grease
Oil
Oil for 8-D & 8½-D
Grease for 9-J
Raise Shield to Oil Screw
CATION CHART
8-D, 8½-D, 9-J
MILLING MACHINES
COOLANT SYSTEM — If the machine is equipped with a coolant system, remove the door at rear of column and fill this compartment with four gallons (if 8½-D) and five gallons (for 9-J) of coolant. Use a water-soluble, emulsifying oil, or similar light bodied compound, rather than a heavy viscous oil.
The light bodied compounds can be handled better with the type of pump furnished and flow off the work better, carrying away the chips and leaving the work fairly clean for constant inspection by the operator.
The heavy bodied oils usually being dark in color and also sticky, cover up the work completely and prevent the chips running off freely, making it difficult for the operator to see what he is doing.

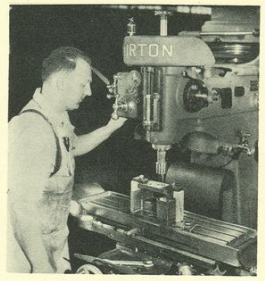
Photo 7



Model 9-J Vertical Miller



Model 9-J Duplicator



Model 9-J Jig Borer

ADJUSTMENT of 8-D, 8½D, 9-J VERTICAL MILLERS and DUPLICATORS

SPINDLE SPEEDS AND BELT

Spindle speeds at the various belt positions in the pulley grooves are shown on the speed plates mounted on Sliding Head. The belt may be staggered to obtain intermediate speeds, as indicated on the speed plates, without undue wear. To change belt position, loosen the tail screw at side of motor housing and run motor in or out with handwheel at back. Do not get belt too tight. It should have about the same tension as the fan belt on an automobile. Before starting motor make sure spindle pulley brake is free of pulley.

CUTTER SPINDLE

Cutter spindle is non-adjustable. It requires no attention. Any looseness of the cutter spindle sleeve is removed by tightening the long Bristo cap screw at front of head casting near spindle nose. This compresses the bushing in head casting, in which spindle slides, and takes up any wear which may have developed. Should play develop in the spindle itself, after a long period of service, the ball bearings should be replaced, which will put the spindle in new condition.

REPLACING CUTTER SPINDLE BEARINGS

The cutter spindle is mounted on its ball bearings in a hardened sleeve, forming a complete unit which is easily removed. This unit is shown on page 11 of milling machine booklet 1400. After removing this from the machine, the ball bearings can be replaced by removing the ball bearing nut on upper end of spindle, and the large slotted end nut which screws into the spindle sleeve on spindle nose end.

TO REMOVE CUTTER SPINDLE SLEEVE UNIT

1) Raise spindle all the way up. 2) Lower table to about 4" below spindle nose and place a wood board 6" to 8" wide and a foot or so long, directly beneath spindle, to protect table. 3) Take off spindle depth stop assembly by removing the three socket cap screws which fasten it to sliding head casting. 4) Remove the long socket cap screw at front of sliding head casting near spindle nose, and insert a set screw of the same diameter in threaded end of clamp screw hole, with head of set screw pointing to the left. 5) Tighten set screw against a flat piece of stock inserted in slot in front of head. This will release spindle sleeve bushing which will be forced sharply down against the board by spring tension. (If not protected by board, table might be dented). 6) Now lower the knee, run sliding head to extreme out position, and table in toward column, permitting removal of spindle sleeve spring and clearance for withdrawing spindle sleeve assembly. 7) Run spindle down with hand wheel or lever until the spindle stop is resting on protruding end of set screw and by inserting a flat piece of steel approximately .445" thick in the slot, directly *above* stop, the slot can be kept open while the set screw is unscrewed, thus permitting removal of sleeve unit. When replacing spindle the two backlash dogs in top of spindle pulley must be held back with a screw driver or taken out altogether by removing the plate on top of spindle pulley.

Photo 8

REMOVING TAPER TOOLS

In loosening taper tools on the 8-D machines which show a tendency to stick in the spindle, unscrew the draw bar a few turns until its collar clears the upper end of spindle 1/8" or so, then tap the draw bar gently with a babbitt hammer. Be careful not to pound on the spindle end itself, as this might damage the closely fitted precision ball bearings on which the spindle is mounted. 8½-D and 9-J machines have a knurled collar which screws on spindle over the standard drawbar used with all B. & S. taper tools, permitting tool to be loosened without driving, by simply unscrewing draw-bar. This collar must be removed, however, when using adapters 472-1 (for 9-J) or 702-1 (for 8½-D), utilizing the Gorton spring collets.

CUTTER SPINDLE BRAKE

The cutter spindle brake has replaceable inserts of Johns-Manville molded brake lining. These brake shoe inserts should be replaced whenever they wear down to the level of the bronze shoes in which they fit. Reference to the sectional views, pages 6 and 7, will show how to remove brake assembly and replace shoes.

CUTTER SPINDLE SPRING COMPENSATOR

Refer to page 8. The spring compensator is mounted on left side of cutter spindle feed shaft and consists of a coil spring fitting around shaft, connected to feed box housing (8½-D, 9-J) and with an outer casting with a split hub clamped to feed shaft. By loosening the clamp screw and turning compensator to left or right, the pressure required to lower the spindle by means of feed lever can be lightened or increased to exactly the desired amount. Before loosening, have spindle in extreme up position. Compensator not furnished on 8-D models except with Duplicator equipment.

TABLE AND SADDLE SCREWS

Adjustable for end play. Ball and roller end thrusts are used on 8-D and 8½-D, Timken on 9-J. To adjust, loosen the Bristo set screw securing the end thrust nut at left end of table screw and front of saddle screw, and turn up nut as required, then tighten set screw.

TABLE AND SADDLE SCREW NUTS

These are bronze alloy, split type and adjustable for wear or any degree of freeness desired, by means of Bristo set screws opposed to Bristo cap screws. To reach the table screw nut it will be necessary to drive out the taper pin holding the collar on right hand end of screw. Then remove the cast bracket on this right hand end of table, from the table, which can then be pulled out far enough to get at nut. To tighten nut, back off the necessary amount on the set screws and then tighten cap screws, thus locking for permanent adjustment. To adjust the saddle nut, proceed in the same way, by first removing collar on screw, then bracket, etc. Table and saddle assembly and parts drawings are shown for the various models on pages 11, 14, 15.

TABLE AND SADDLE GIBS

These are tapered with adjusting screw at one end and locking screw at other end. To tighten gib, loosen locking screw at small end of gib, tightening screw at opposite end as required.

KNEE GIB

This has a tapered side and is taken up by tightening the hexagon nuts and lock nuts at rear of gib.

FOOT TREADLE

Only the 8-D comes with foot treadle as standard equipment, but foot treadles can be furnished for 8½-D and 9-J at extra cost. All foot treadles, regardless of size, have the same construction. Leverage is adjustable by inserting the threaded pin with the knurled end in the various holes of the upper angular casting pivoted on sliding head. Foot treadle can be quickly disconnected by removing the horizontal tie rod connecting to spindle feed shaft.

POWER FEED BOX SHEARING PINS

On all machines having power longitudinal feed to table, there is a shearing pin, located just to the front of the bevel gear housing where the power feed shaft comes out of the gear box. On machines equipped also with power cross feed, a second shearing pin is located at rear end of saddle screw. To get at this pin for replacement, feed the saddle to the front as far as it will go, using the feed handwheel. This will permit driving out shearing pin and replacing. Power feed box assembly and parts drawings for the various machines are shown on pages 11, 12, 13, 14, 15, 16, 17.

Photo 9

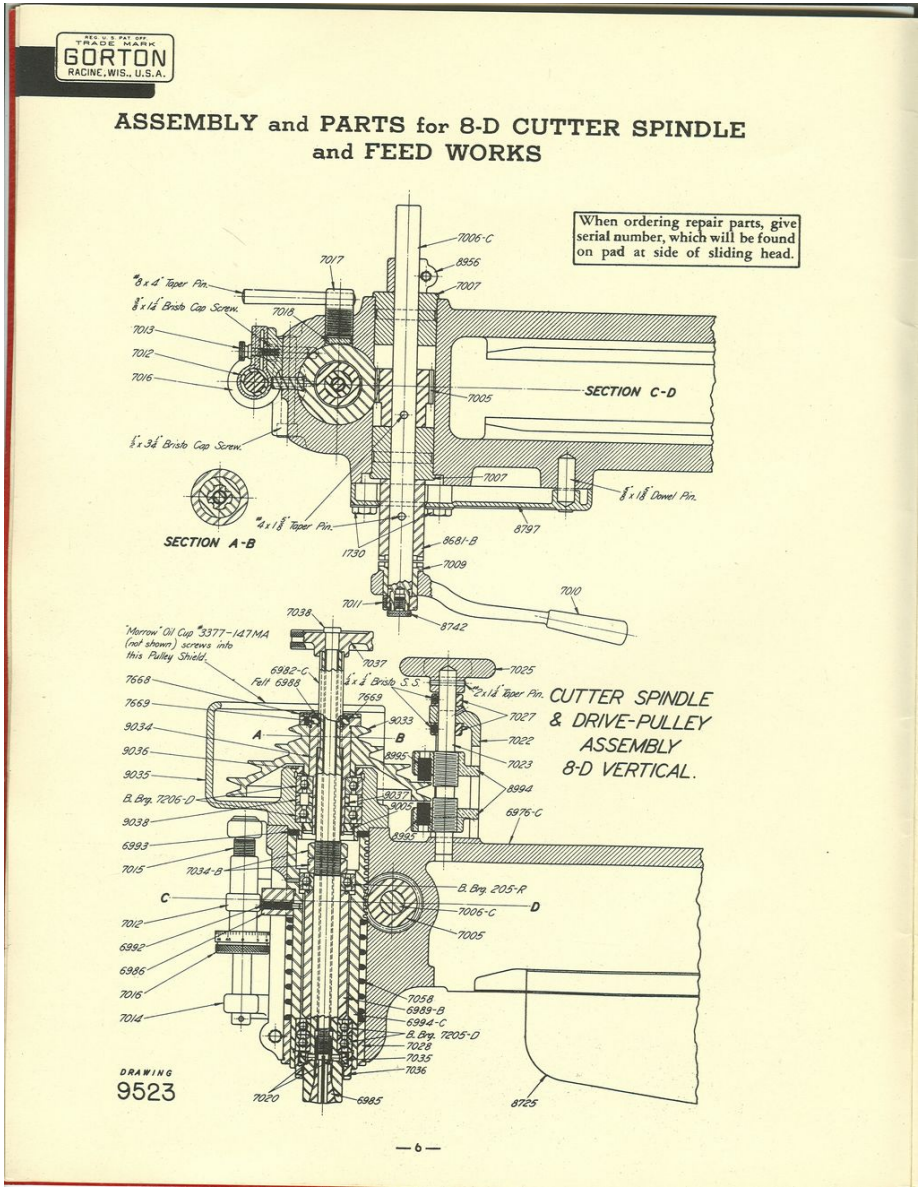

GORTON
RACINE, WIS., U.S.A.
ASSEMBLY and PARTS for 8-D CUTTER SPINDLE and FEED WORKS
When ordering repair parts, give serial number, which will be found on pad at side of sliding head.
SECTION C-D
SECTION A-B
CUTTER SPINDLE & DRIVE-PULLEY ASSEMBLY 8-D VERTICAL.
DRAWING 9523
—6—

Photo 10

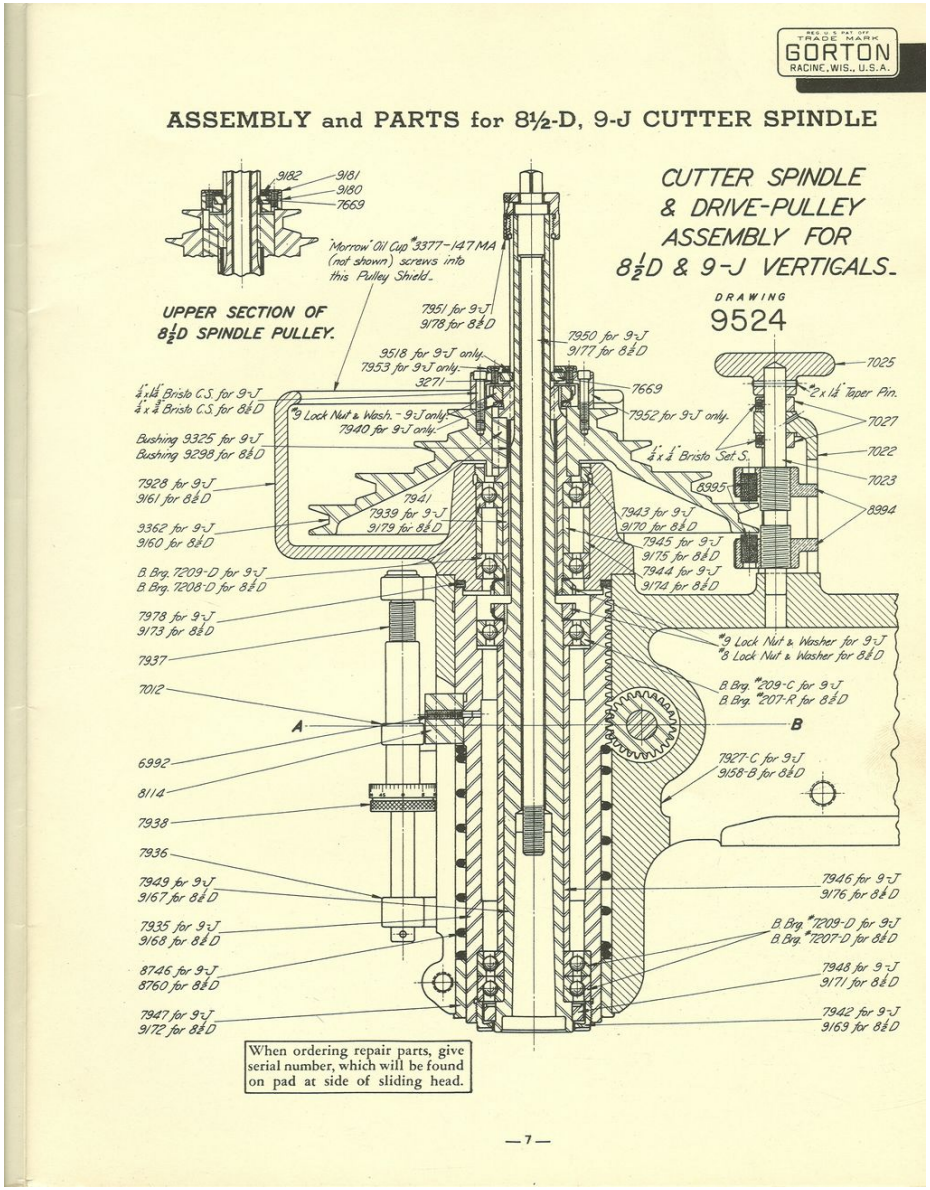

GORTON
RACINE, WIS., U.S.A.
ASSEMBLY and PARTS for 8½-D, 9-J CUTTER SPINDLE
CUTTER SPINDLE & DRIVE-PULLEY ASSEMBLY FOR 8½D & 9-J VERTICALS.
DRAWING 9524
UPPER SECTION OF 8½D SPINDLE PULLEY.
9182
9181
9180
7669
"Morrow" Oil Cup #3377-147 MA (not shown) screws into this Pulley Shield.
7951 for 9-J
9178 for 8½D
7950 for 9-J
9177 for 8½D
9518 for 9-J only.
7953 for 9-J only.
3271
7669
7025
2 x 1¼ Taper Pin.
7027
7022
7023
8995
8994
7952 for 9-J only.
¼" x ¼" Bristo Set S.
#9 Lock Nut & Wash. - 9-J only.
7940 for 9-J only.
Bushing 9325 for 9-J
Bushing 9298 for 8½D
7928 for 9-J
9161 for 8½D
7941
7939 for 9-J
9179 for 8½D
9362 for 9-J
9160 for 8½D
7943 for 9-J
9170 for 8½D
7945 for 9-J
9175 for 8½D
7944 for 9-J
9174 for 8½D
B. Brg. 7209-D for 9-J
B. Brg. 7208-D for 8½D
7978 for 9-J
9173 for 8½D
7937
#9 Lock Nut & Washer for 9-J
#8 Lock Nut & Washer for 8½D
7012
B. Brg. #209-C for 9-J
B. Brg. #207-R for 8½D
A
B
6992
8114
7938
7927-C for 9-J
9158-B for 8½D
7936
7949 for 9-J
9167 for 8½D
7946 for 9-J
9176 for 8½D
7935 for 9-J
9168 for 8½D
B. Brg. #7209-D for 9-J
B. Brg. #7207-D for 8½D
8746 for 9-J
8760 for 8½D
7948 for 9-J
9171 for 8½D
7947 for 9-J
9172 for 8½D
7942 for 9-J
9169 for 8½D
When ordering repair parts, give serial number, which will be found on pad at side of sliding head.
—7—

Photo 11

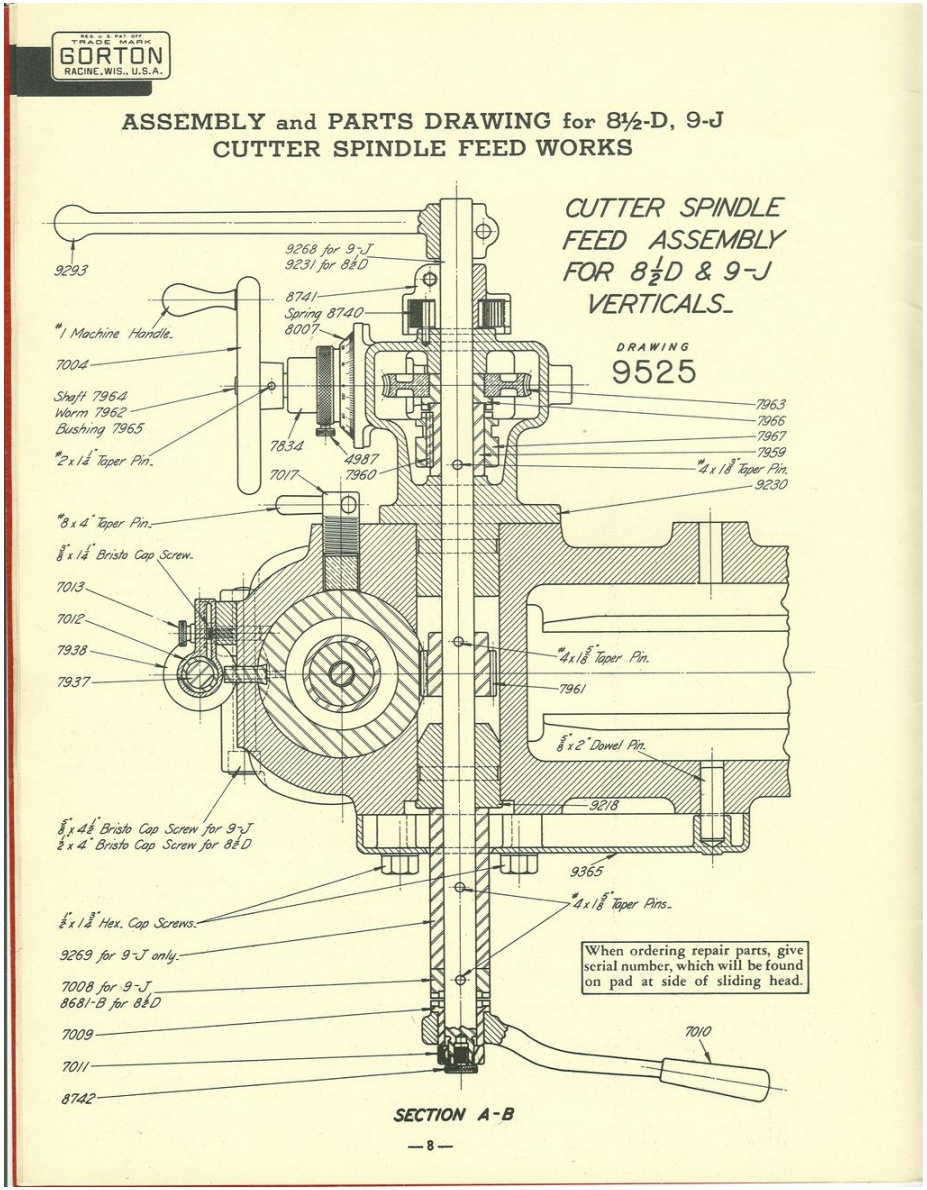

GORTON
RACINE, WIS., U.S.A.
ASSEMBLY and PARTS DRAWING for 8½-D, 9-J
CUTTER SPINDLE FEED WORKS
CUTTER SPINDLE FEED ASSEMBLY FOR 8½D & 9-J VERTICALS.
DRAWING
9525
9293
9268 for 9-J
9231 for 8½D
8741
Spring 8740
8007
"I Machine Handle.
7004
Shaft 7964
Worm 7962
Bushing 7965
"2 x 1¼" Taper Pin.
7834
4987
7960
7017
"8 x 4" Taper Pin.
⅜" x 1¼" Bristo Cap Screw.
7013
7012
7938
7937
⅜" x 4½" Bristo Cap Screw for 9-J
⅜" x 4" Bristo Cap Screw for 8½D
⅜" x 1¾" Hex. Cap Screws.
9269 for 9-J only.
7008 for 9-J
8681-B for 8½D
7009
7011
8742
7963
7966
7967
7959
"4 x 1⅜" Taper Pin.
9230
"4 x 1⅜" Taper Pin.
7961
⅜" x 2" Dowel Pin.
9218
9365
"4 x 1⅜" Taper Pins.
When ordering repair parts, give serial number, which will be found on pad at side of sliding head.
7010
SECTION A-B
—8—

Photo 12

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

ADJUSTMENTS AND LUBRICATION of 8-D, 8½-D, 9-J DUPLICATOR TABLES

Adjustment of Table Slides

The ball bearing table slides must be very accurately adjusted to do accurate work. Should trouble of any kind develop it is best to advise the factory first, and if necessary, return the Duplicator Table to the factory where it can be accurately adjusted with special tools and gauges. For this reason we do not show a cross section or parts list of Duplicator Tables here.

Cleaning with Compressed Air

While the ball bearing slides of table are well protected against dirt by felt wipers and leather aprons, it is possible when using compressed air in cleaning off chips, etc., on the machine, to force some of these into the ball bearings and damage them. For this reason be careful not to get the air blast underneath or on the ends of the table, where chips might be blown into the slides.

Protecting Clamp Screw Holes

When cap screws for locking table (at each end) are removed, always insert a plug or cork in the left hand hole to prevent chips and dirt clogging threads below. This is important, as it is very difficult to clean out chips once they get into this hole and have been forced into the threads with the cap screw.

Master Copy Table

Should be removed occasionally from Duplicator table and thoroughly cleaned between the joints as the dirt and minute particles of metal work underneath, cause inaccurate settings if this is not done.

Lubrication of Table

Every month apply a few drops of medium heavy machine oil of same grade recommended for the cutter spindle, page 3, to the ball bearing slides,—through the holes in table top marked "OIL," also through oil cups at front and back of Duplicator Table Cross-slides, beneath the leather apron. At the same time oil the ball and socket joints at lower end of lever for operating table. Keep the table clean and at the end of each day run out the hardened table longitudinal and cross slides as far as possible and wipe off any dirt with a clean, oily rag, taking care not to leave any lint from rag on slide.

ADJUSTMENT and LUBRICATION of 8-D, 8½-D, 9-J DUPLICATOR TRACER HEADS—See Drg., Page 10

TRACER HEAD SIZES

The small head, 599-2, fits 8-D machines only. The two larger sizes, 701-1 for 8½-D and 705-1 for 9-J machines, are interchangeable, and identical in every respect except the length of the head casting which determines the distance between cutter and tracer spindles. Many of the parts used in these larger heads are also used in the small 599-2. We therefore show only one cross section for all size heads, giving the correct piece numbers for parts used on the various heads.

ADJUSTMENT OF TRACER HEAD COUPLING

Should adjustment of this coupling become necessary for the reason explained in paragraph "d", page 20, proceed as follows: Loosen cap screws —by reaching in through the cored hole in rear of head casting. Then push the tracer head spindle up or down as required, and tighten cap screws. Make sure that the cap screws are tight, as the slightest slippage will ruin the accuracy of the depth reproduction. This adjustment is not intended to be made in other than exceptional cases where there may be a great difference in thickness between master and work, and where it is not practical to block up under one or the other.

ADJUSTMENT OF TRACER HEAD SPINDLE

The tracer head spindle slides in a hardened, adjustable bushing of exactly the same construction as on the milling machine spindle. Any degree of freedom can be obtained by tightening the Bristo cap screw—at front of head casting. This compresses the bushing around tracer spindle.

LUBRICATION OF TRACER HEAD

Use any medium machine oil as specified on page 3. Fill hinge lid oilers once a week and squirt a few drops in the oil hole at rear of micrometer dial at top, on the sliding sleeve and lower bushing, also on threaded portion. Keep the entire assembly wiped clean with an oily rag.

Photo 13

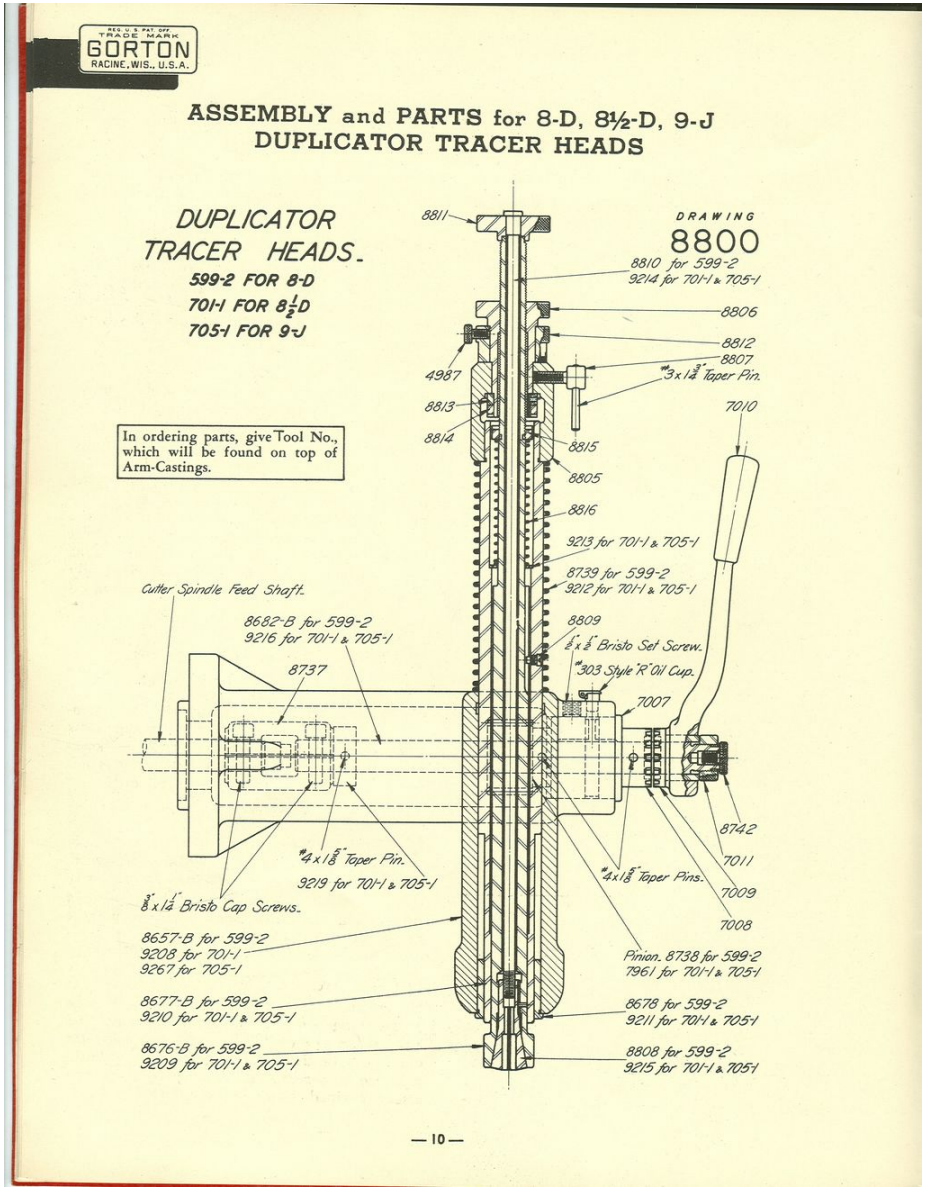

GORTON
RACINE, WIS., U.S.A.
ASSEMBLY and PARTS for 8-D, 8½-D, 9-J
DUPLICATOR TRACER HEADS
DUPLICATOR
TRACER HEADS.
599-2 FOR 8-D
701-1 FOR 8½D
705-1 FOR 9-J
In ordering parts, give Tool No., which will be found on top of Arm-Castings.
DRAWING
8800
8811
8810 for 599-2
9214 for 701-1 & 705-1
8806
8812
8807
#3x1⅜" Taper Pin.
4987
8813
8814
7010
8815
8805
8816
9213 for 701-1 & 705-1
8739 for 599-2
9212 for 701-1 & 705-1
Cutter Spindle Feed Shaft.
8682-B for 599-2
9216 for 701-1 & 705-1
8809
⅜"x⅜" Bristo Set Screw.
#303 Style 'R' Oil Cup.
8737
7007
8742
7011
#4x1⅛" Taper Pin.
9219 for 701-1 & 705-1
#4x1⅛" Taper Pins.
7009
7008
⅜"x1¼" Bristo Cap Screws.
8657-B for 599-2
9208 for 701-1
9267 for 705-1
Pinion. 8738 for 599-2
7961 for 701-1 & 705-1
8677-B for 599-2
9210 for 701-1 & 705-1
8678 for 599-2
9211 for 701-1 & 705-1
8676-B for 599-2
9209 for 701-1 & 705-1
8808 for 599-2
9215 for 701-1 & 705-1
— 10 —

Photo 14

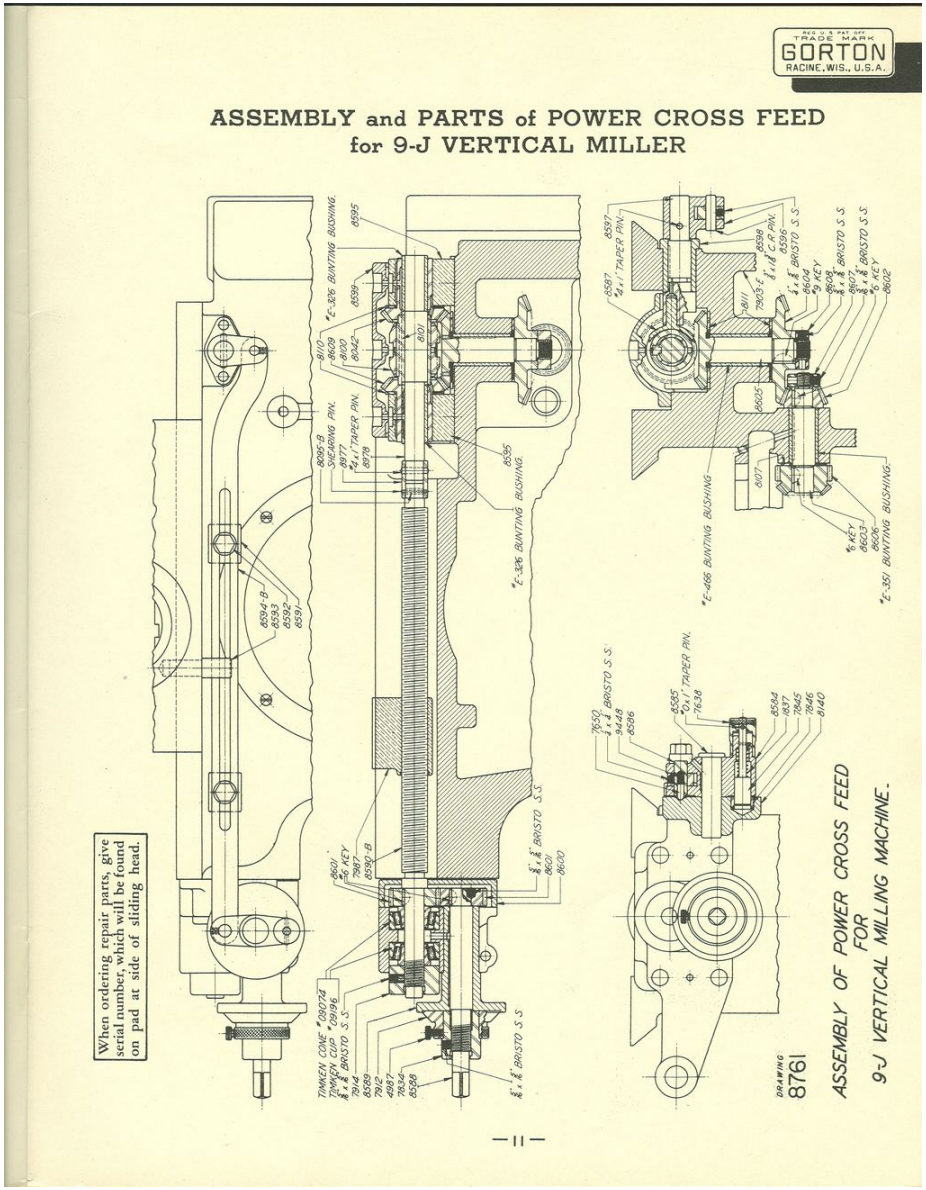

REG. U.S. PAT. OFF.
TRADE MARK
GORTON
RACINE, WIS., U.S.A.
ASSEMBLY and PARTS of POWER CROSS FEED
for 9-J VERTICAL MILLER
When ordering repair parts, give serial number, which will be found on pad at side of sliding head.
ASSEMBLY OF POWER CROSS FEED
FOR
9-J VERTICAL MILLING MACHINE.
DRAWING
8761
—11—

Photo 15

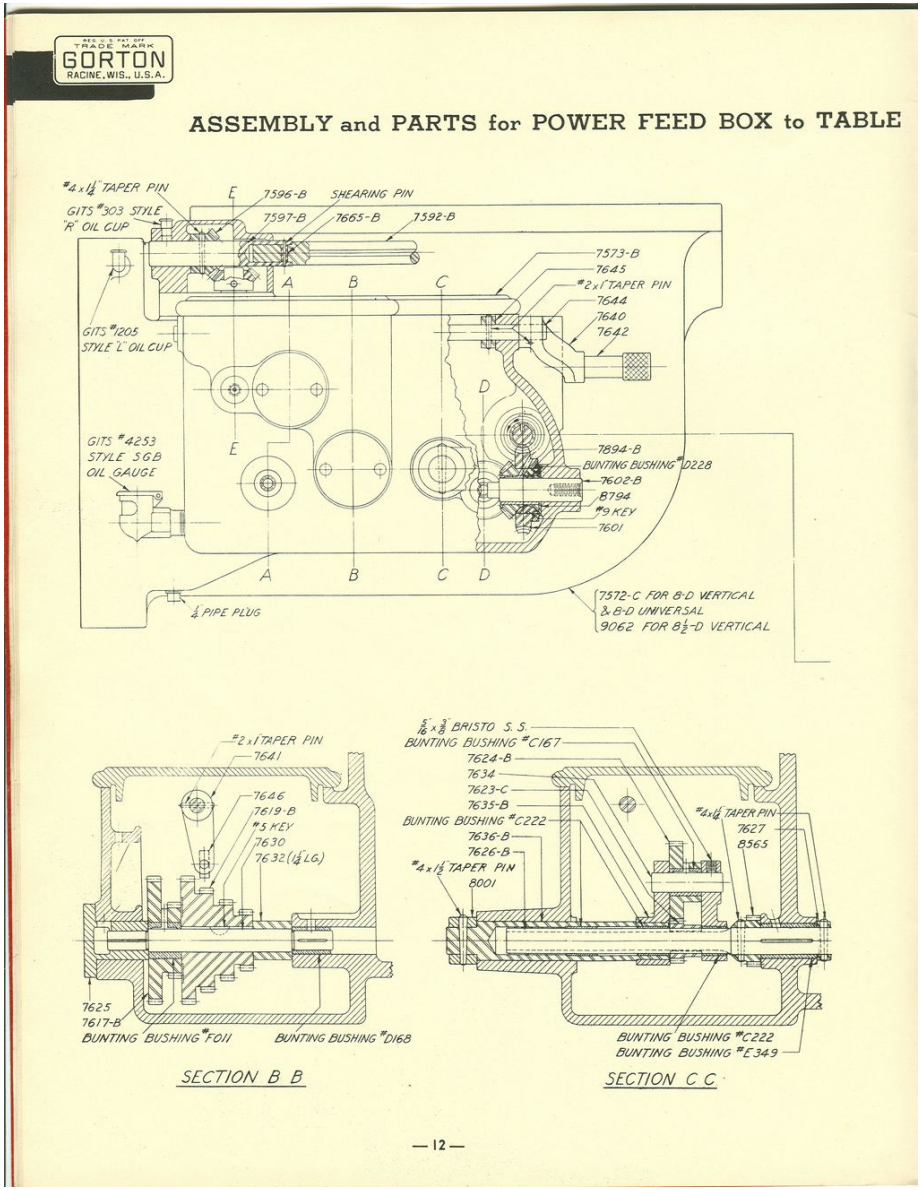

GORTON
RACINE, WIS., U.S.A.
ASSEMBLY and PARTS for POWER FEED BOX to TABLE
#4 x 1¼" TAPER PIN
GITS #303 STYLE "R" OIL CUP
E
7596-B
SHEARING PIN
7597-B
7665-B
7592-B
7573-B
7645
#2 x 1" TAPER PIN
7644
7640
7642
A
B
C
D
GITS #205 STYLE "L" OIL CUP
GITS #4253 STYLE SGB OIL GAUGE
7894-B
BUNTING BUSHING #D228
7602-B
B794
#9 KEY
7601
¼ PIPE PLUG
7572-C FOR B-D VERTICAL & B-D UNIVERSAL
9062 FOR B½-D VERTICAL
#2 x 1 TAPER PIN
7641
7646
7619-B
#5 KEY
7630
7632 (¼ LG)
7625
7617-B
BUNTING BUSHING #F011
BUNTING BUSHING #D168
SECTION B B
⅝ x ⅜ BRISTO S.S.
BUNTING BUSHING #C167
7624-B
7634
7623-C
7635-B
BUNTING BUSHING #C222
7636-B
7626-B
#4 x 1½ TAPER PIN
8001
#4 x 1½ TAPER PIN
7627
8565
BUNTING BUSHING #C222
BUNTING BUSHING #E349
SECTION C C
— 12 —

Photo 16

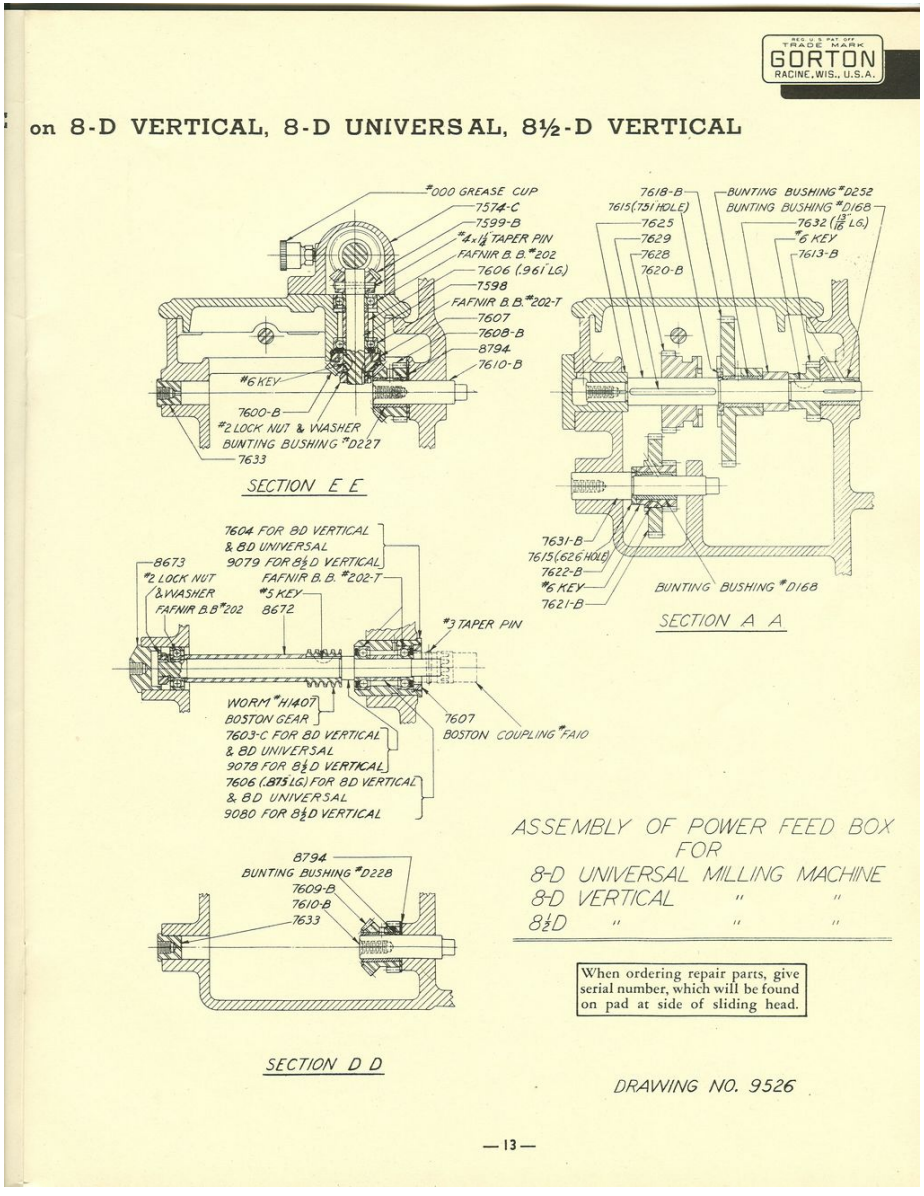

GORTON
RACINE, WIS., U.S.A.
on 8-D VERTICAL, 8-D UNIVERSAL, 8½-D VERTICAL
#000 GREASE CUP
7574-C
7599-B
#4 x ½ TAPER PIN
FAFNIR B. B. #202
7606 (.961 LG.)
7598
FAFNIR B.B. #202-T
7607
7608-B
8794
7610-B
#6 KEY
7600-B
#2 LOCK NUT & WASHER
BUNTING BUSHING #D227
7633
SECTION E E
7618-B
7615 (.751 HOLE)
7625
7629
7628
7620-B
BUNTING BUSHING #D252
BUNTING BUSHING #D168
7632 (⅜ LG.)
#6 KEY
7613-B
7631-B
7615 (.626 HOLE)
7622-B
#6 KEY
7621-B
BUNTING BUSHING #D168
SECTION A A
7604 FOR 8D VERTICAL & 8D UNIVERSAL
9079 FOR 8½D VERTICAL
8673
#2 LOCK NUT & WASHER FAFNIR B.B. #202
FAFNIR B.B. #202-T
#5 KEY
8672
#3 TAPER PIN
WORM #H1407
BOSTON GEAR
7603-C FOR 8D VERTICAL & 8D UNIVERSAL
9078 FOR 8½D VERTICAL
7606 (.875 LG.) FOR 8D VERTICAL & 8D UNIVERSAL
9080 FOR 8½D VERTICAL
7607
BOSTON COUPLING #FA10
8794
BUNTING BUSHING #D228
7609-B
7610-B
7633
SECTION D D
ASSEMBLY OF POWER FEED BOX FOR
8-D UNIVERSAL MILLING MACHINE
8-D VERTICAL " "
8½D " " "
When ordering repair parts, give serial number, which will be found on pad at side of sliding head.
DRAWING NO. 9526
— 13 —

Photo 17

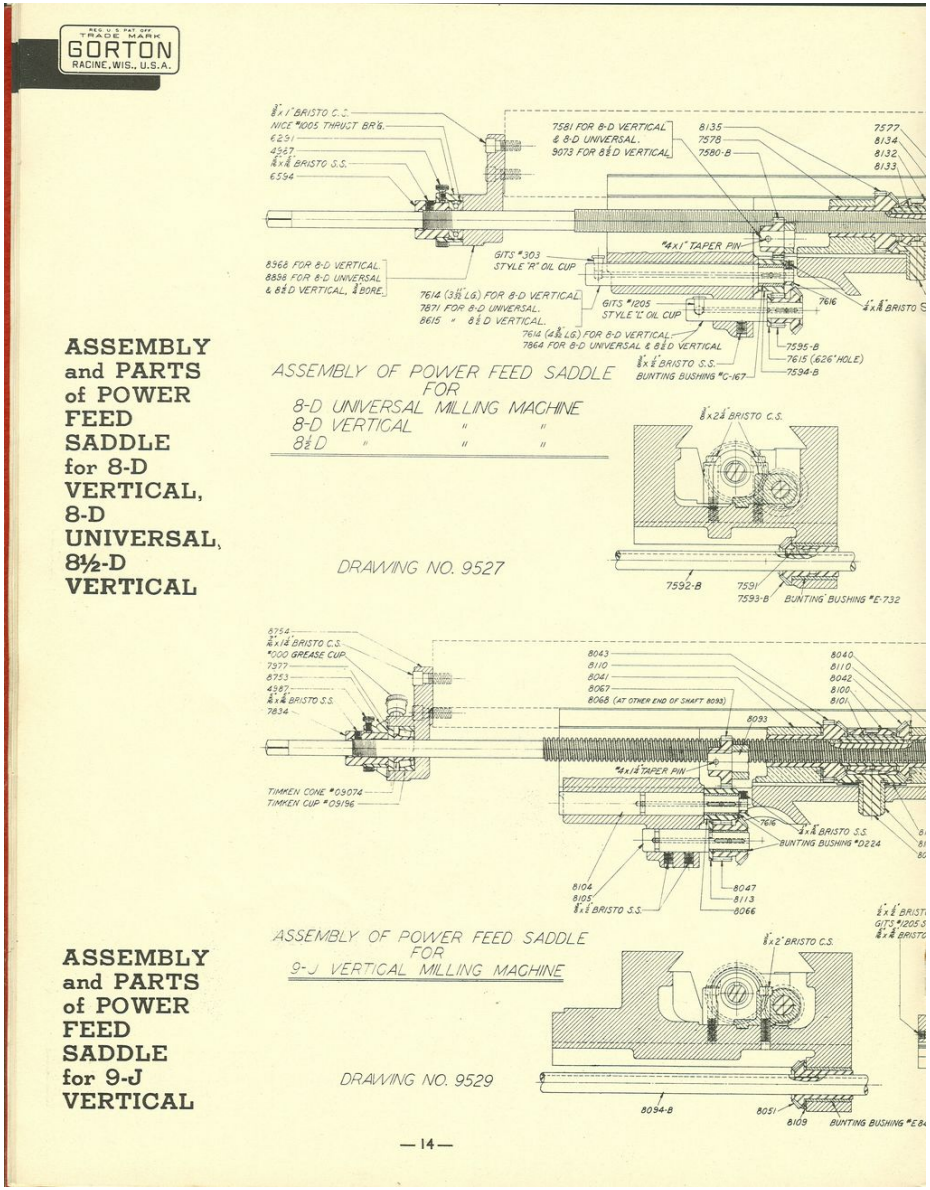

GORTON
RACINE, WIS., U.S.A.
ASSEMBLY and PARTS of POWER FEED SADDLE for 8-D VERTICAL, 8-D UNIVERSAL, 8½-D VERTICAL
ASSEMBLY OF POWER FEED SADDLE FOR
8-D UNIVERSAL MILLING MACHINE
8-D VERTICAL " "
8½D " " "
DRAWING NO. 9527
ASSEMBLY and PARTS of POWER FEED SADDLE for 9-J VERTICAL
ASSEMBLY OF POWER FEED SADDLE FOR
9-J VERTICAL MILLING MACHINE
DRAWING NO. 9529
— 14 —

Photo 18

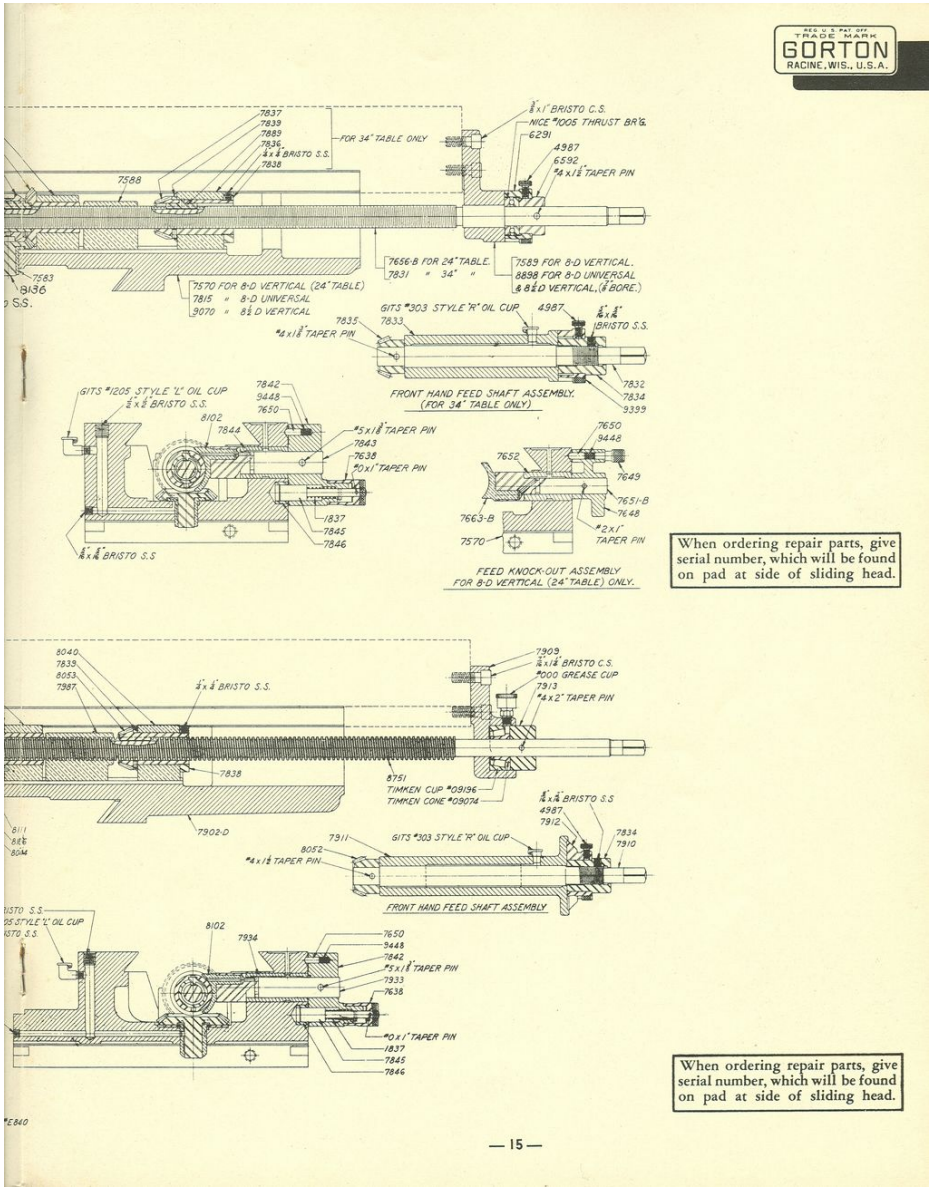

GORTON
RACINE, WIS., U.S.A.
FOR 34" TABLE ONLY
7588
7570 FOR 8-D VERTICAL (24" TABLE)
7815 " 8-D UNIVERSAL
9070 " 8½ D VERTICAL
7656-B FOR 24" TABLE.
7831 " 34" "
7589 FOR 8-D VERTICAL.
8898 FOR 8-D UNIVERSAL & 8½ D VERTICAL, (⅝" BORE.)
GITS #303 STYLE "R" OIL CUP
FRONT HAND FEED SHAFT ASSEMBLY. (FOR 34" TABLE ONLY)
GITS #1205 STYLE "L" OIL CUP
FEED KNOCK-OUT ASSEMBLY FOR 8-D VERTICAL (24" TABLE) ONLY.
When ordering repair parts, give serial number, which will be found on pad at side of sliding head.
7838
7902-D
8751
TIMKEN CUP #09196
TIMKEN CONE #09074
7911
FRONT HAND FEED SHAFT ASSEMBLY
When ordering repair parts, give serial number, which will be found on pad at side of sliding head.
— 15 —

Photo 19

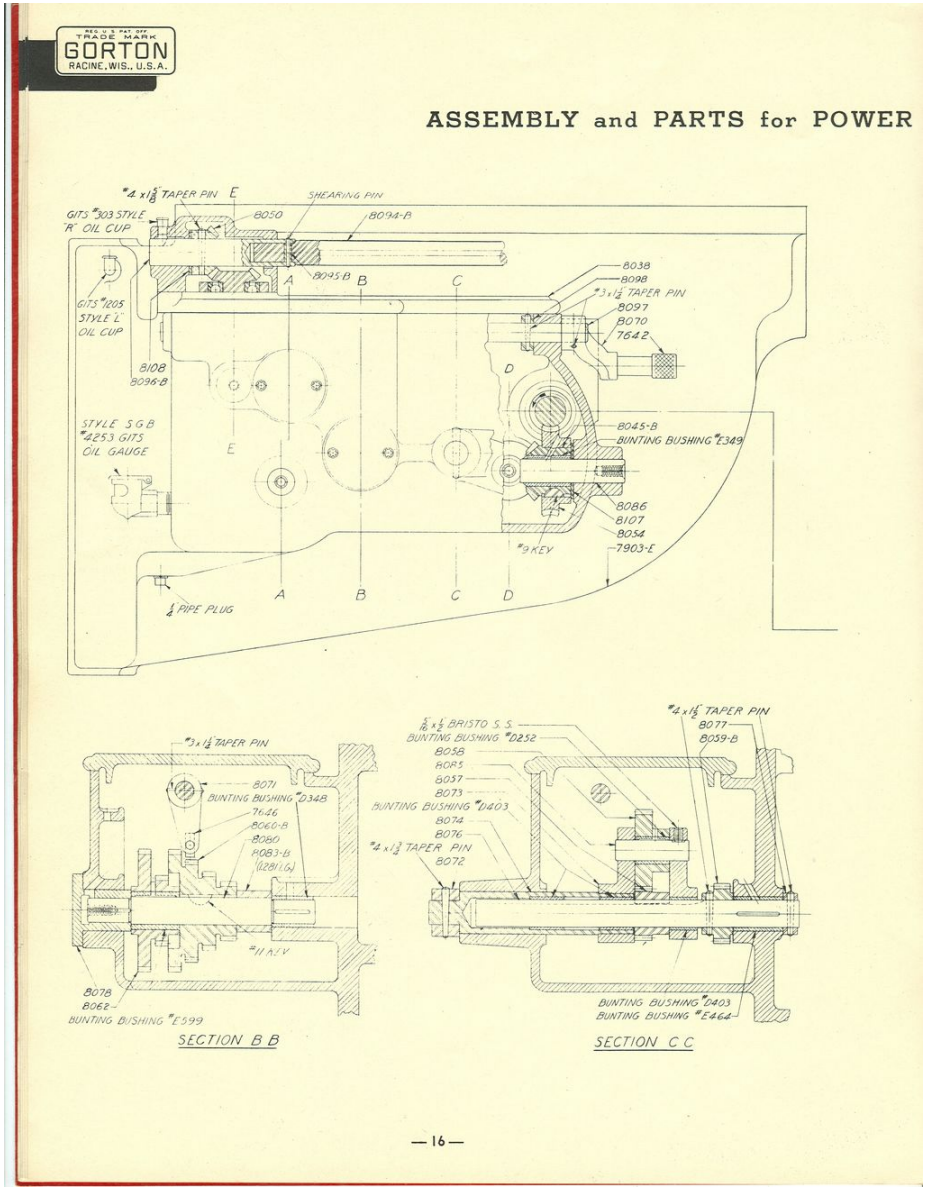
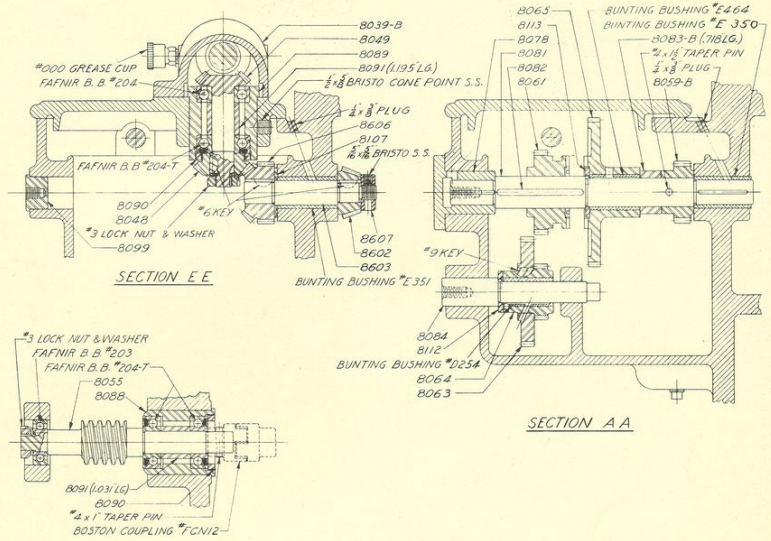
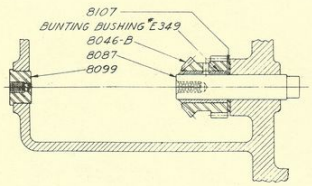

GORTON
RACINE, WIS., U.S.A.
ASSEMBLY and PARTS for POWER
SECTION B B
SECTION C C
— 16 —

Photo 20

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

FEED BOX to TABLE on 9-J VERTICAL





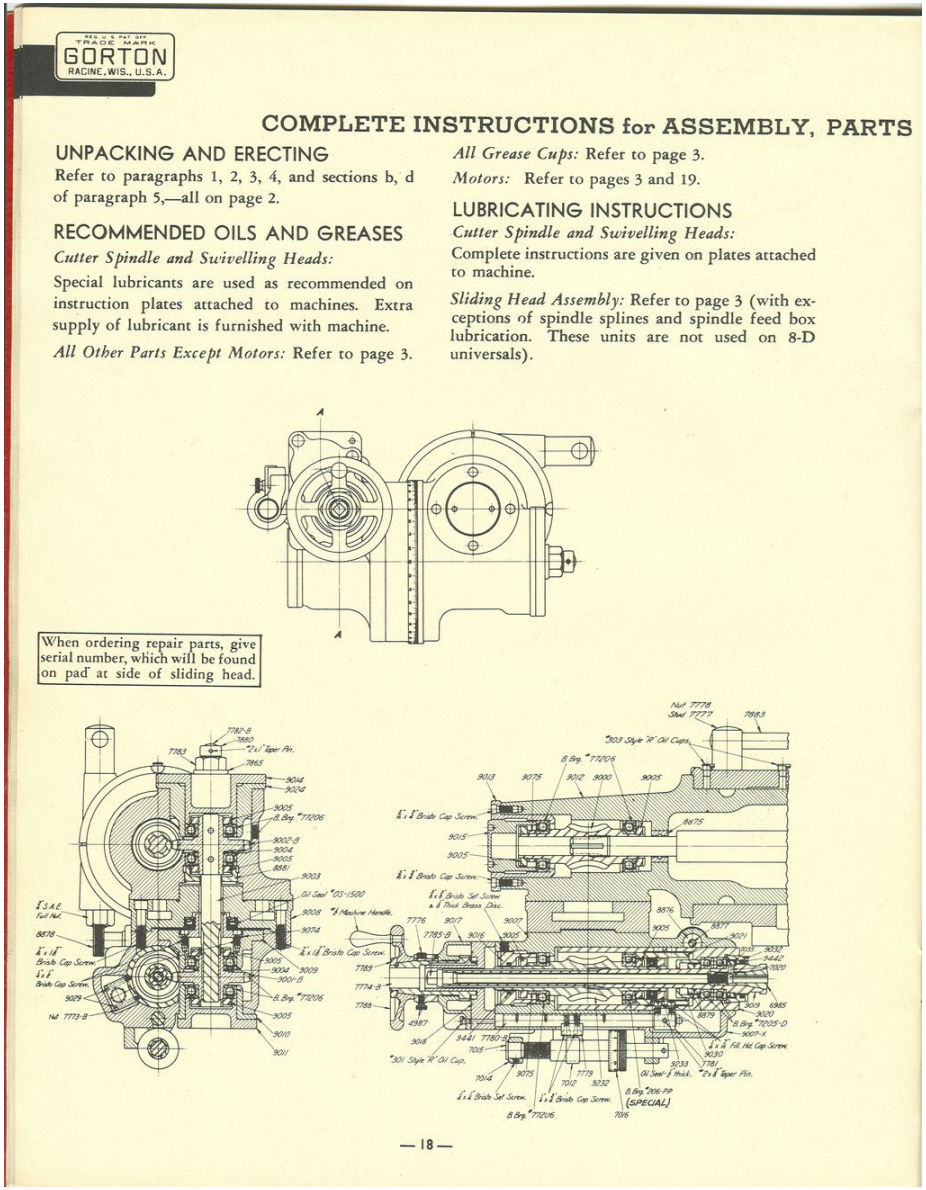
SECTION D D

ASSEMBLY OF POWER FEED BOX
FOR
No. 9-J VERTICAL MILLING MACHINE

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

DRAWING NO. 9528

Photo 21



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

COMPLETE INSTRUCTIONS for ASSEMBLY, PARTS

UNPACKING AND ERECTING

Refer to paragraphs 1, 2, 3, 4, and sections b, d of paragraph 5,—all on page 2.

RECOMMENDED OILS AND GREASES

Cutter Spindle and Swivelling Heads:

Special lubricants are used as recommended on instruction plates attached to machines. Extra supply of lubricant is furnished with machine.

All Other Parts Except Motors: Refer to page 3.

All Grease Cups: Refer to page 3.

Motors: Refer to pages 3 and 19.

LUBRICATING INSTRUCTIONS

Cutter Spindle and Swivelling Heads:

Complete instructions are given on plates attached to machine.

Sliding Head Assembly: Refer to page 3 (with exceptions of spindle splines and spindle feed box lubrication. These units are not used on 8-D universals).

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

Photo 22

and ADJUSTMENT of 8-D UNIVERSAL MILLERS

Table, Saddle and Knee Assembly: Refer to page 3.

Spindle Motor (Horizontal type): Lubricate both end bearings as instructions, page 3.

ADJUSTMENTS

Spindle Speeds and Belt Adjustment: Refer to page 4.

Removing Taper Tools: Refer to page 5.

Table Screw: Refer to page 5, also assembly and parts drawing, pages 12, 13, 14, 15.

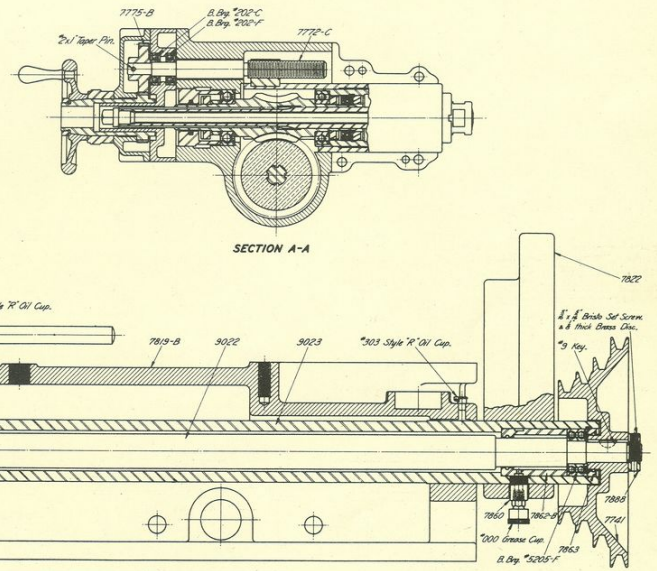
Saddle Screw: Refer to page 5.

Table and Saddle Screw Nuts: Refer to page 5, also assembly and parts drawing, pages 12, 13, 14, 15.

Table and Saddle Gibs: Refer to page 5.

Knee Gib: Refer to page 5.

Power Feed Box Shearing Pin: Refer to page 5, also assembly and parts drawing, pages 12, 13, 14, 15.



ASSEMBLY OF UNIVERSAL HEAD
FOR 8-D UNIVERSAL MILLING MACHINE.

DRAWING 9286

Photo 23

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

DIE and MOLD CUTTING on 8-D, 8½-D, 9-J DUPLICATORS

NOTE: While reading the following instructions it will be found helpful to refer to pages 8 and 9 of Duplicator Bulletin 1319-A.

SETTING UP WORK

a) Placing Work and Master

Lock the Duplicator Table by means of the two long cap screws, one at each end of table. Be careful to clean all chips from table so they will not become imbedded when work is clamped down. It is best to place a sheet of paper beneath work and master before placing on table. *Caution:* Do not drop tools or wrenches on the table, and avoid pulling up work and master clamp studs too tightly.

b) Locating

Locate work in approximately the same relation to cutter spindle as master is to tracer spindle, and clamp both in position. Place tracing styles of equal size in both cutter and tracer spindles and move the milling machine table with cranks on table screws until style is touching sides of die block. (If locating from a layout use a pointed style.)

Shift master table by means of the micrometers provided, until it is in perfect relation to the die block, then tighten master table clamp screws. If an accurate job is required, place a thickness gauge between style in cutter spindle and work—and between style in tracer spindle and master. Adjust master and work until the same amount of tension is required to withdraw both gauges at the same time. (If two gauges are not available, paper will do.)

c) Cutter and Tracer Sizes

Now remove tracing styles from both spindles. It is best to use the largest possible tracer for roughing, even though it may not reach into the smaller sections of the die or mold. These can be finished later. After selecting the tracer, use a cutter considerably smaller, say .030", thus allowing ample stock for final finishing. Now adjust the tracer spindle vertically by means of the micrometer screw and collar at top until both cutter and tracer spindles are touching work and master. Then turn micrometer screw counterclockwise and lower tracing style .030" lower than cutter point. This allows sufficient stock on bottom for finishing. (It is best to select some section of the die or mold as a locating point from which to check cutter depth whenever cutter changes are made.)

d) Adjustment for unequal thickness of master and work

Occasional jobs may be found with more variation between thickness of work and thickness of master than can be obtained in the vertical screw adjustment of tracer spindle. The tracer head coupling can then be adjusted as explained on page 9.

ROUGHING OUT

e) Setting for Depth

With Duplicator Table still locked as explained in a) above, run the cutter down into the work sufficiently deep for a roughing cut. This can be done, either by means of left hand lever, or with the micrometer feed handwheel. If by lever, it will be necessary to lock the spindle with the spindle lever lock at left side, when the desired cutter depth has been reached.

f) Preliminary roughing with table screws

This is done using the tracing style as a guide, spindle locked, and operator using both hands to operate the milling machine table screws. After removing most of the stock it may be advisable to change to smaller cutter and style so as to get into the smaller crevices and obtain more detail, but always allowing ample stock for finishing as explained above under c).

SEMI-FINISHING

g) Finishing with combination of table screws and lever

When the stock has been removed as above to within 1/16" or 3/32" of finished size, remove the cap screws at both ends of Duplicator Table, which lock it in place, thus permitting free movement by means of the table lever. Now clamp either the Duplicator Table longitudinal slide, or cross slide, depending on location and shapes of work, by means of U clamp and cap screw located at front of table. This permits free movement of table with lever, in one direction only. The duplicator table lever can be adjusted for length so as to obtain greater or less leverage against the cut. After feeding cutter across the work, move the milling machine table a few thousandths with the table screws, and feed across with the Duplicator lever, continuing in this way until the die or mold has been completely gone over. During

Photo 24

this operation it may be advisable to release the cutter spindle lock, permitting free vertical movement of cutter spindle, as the tracer follows the vertical contours of the master (being held in constant contact with master by left hand lever). During this operation, the table may be found too sensitive, with a tendency to jump away from the cutter and chatter. In this case, adjust the Friction brake to the desired degree of tension by means of the knurled screw located on the under side of duplicator table directly beneath the master table.

FINISHING

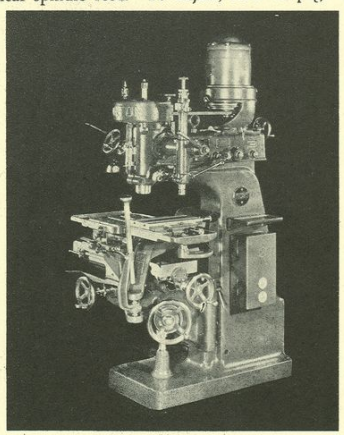
h) Finishing with levers entirely

When the work is within .030" to .050" of size, it is ready to finish, using the levers entirely. Now remove the U clamp at front of table, which clamped one of the table slides as in g) page 20, permitting free movement of table in all directions by means of lever. Now with left hand operating the spindle lever, and right hand the table lever, begin at the top of the job, following around in a clockwise motion and keeping the tracing style in continuous contact with master. Keep the cutter feeding into the stock by maintaining a constant pressure against the table lever. The friction brake (g above) may need further adjustment. Also the cutter spindle spring compensator, for more sensitive operation of the vertical spindle feed. To adjust, refer to page 5.

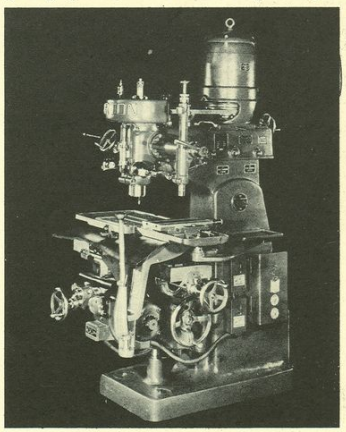
After completing a cut all the way around the cavity, lower cutter spindle a few thousandths and repeat until finally reaching the bottom of the cavity. This will leave a series of slight steps extending laterally all around the cavity, or punch, as the case may be. These steps can now be removed by starting at the top of cavity and feeding down to the bottom, a motion at right angles to the steps already made. This is accomplished with an even pull of the left hand lever while holding the table lever in the right hand, closely enough to prevent chatter. Always start at the top and feed down. A little practice will show how to coordinate the two lever movements to produce a smooth cut.

i) Checking work and master

At this point it is well to check the work and master, to determine whether a smaller diameter style will be necessary to bring the work to the finished size. Some jobs can be finished with the second cutter; oftentimes more are necessary, depending on finish and accuracy desired. In most cases, even for the final finish, the tracing style is 3 or 4 thousandths larger than the cutter to avoid under-cutting at some critical point, by forcing the cutter too hard, thus springing the cutter and tracing styles and making tool marks too deep to polish out. It is general practice to leave about .002" stock on most dies and molds requiring a high polish, for the final hand polishing.



8½-D Duplicator with Hand Feed



9-J Duplicator with Power Feed

Photo 25

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

MODELS for DIE and MOLD DUPLICATING

Original Steel Dies or Molds

Since Gorton Duplicators operate direct on a 1 to 1 ratio, the work produced will be no better than the original or model used. It is impossible to make up a wood or stone model to the close tolerances required for very accurate work, so we recommend wherever possible that original steel dies be used to duplicate from. Sometimes only a portion of the die may be used, or several dies combined to make a new one.

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 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 Duplicator 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 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 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

Bakelite or other plastics make very good models, being in many cases as practical as steel originals. Where a manufacturer has plastic molding equipment, it is often practicable to mold a plastic model from a steel die. Such a master is illustrated on page 13 of Duplicator Bulletin 1319-A. In some cases an actual molded piece may be used, being mounted with screws to a plate for holding on master table. It is often possible to carve a model from a plastic material. For such models we recommend 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. Either 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, ground tooth burrs 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.

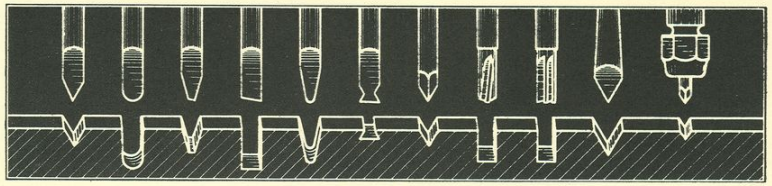
Putty

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 26

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

CUTTERS for DIE and MOLD WORK



Typical Cutter Points and Cuts

Types of Cutters Recommended

The various types and sizes of cutters which have proven most satisfactory for die and mold work are shown in Gorton Cutter Booklet, also in Accessories Catalog. We list and carry in stock a convenient assortment of these cutters especially recommended for Duplicator use and for die and mold work in general. This set contains one each of the various sizes and styles necessary, in a convenient metal tray for permanent use of operator. This set is known as Duplicator set 709-1.

We find the four spiral flute mills, in either conventional or fast spiral types, are very good for side milling, as profiling punches, etc., but nothing else. Two flute mills can be fed down into the work like a drill and will also do side milling, but they are difficult to grind to the various shapes and odd sizes required in die and mold duplicating. For this reason the most satisfactory cutters are our Gorton single flutes. These possess greater strength (especially in the small sizes) and will stand higher speeds and faster feeds than any other type of cutter we have tried. They produce a smooth bottom cut, are easily sharpened or ground to other shapes or clearances. The low initial cost combined with cheap resharpening and reduced losses through breakage will result in savings from 50% to 150% on die and mold work, —as compared with any other type of cutter.

Coolant

See "Coolant System," page 4.

Cutter Speeds and Feeds

See page 28.

Condition of Cutters

Cutters must be kept sharp and with proper clearance at all times. This is particularly important when running at high speeds as a dull cutter burns quickly. If a cutter raises a burr, it is pretty certain to be dull or without clearance, or both.
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 cutters used with Gorton Duplicators. If you do not have suitable equipment, we would suggest the purchase of a Gorton grinder, as shown in separate booklet. A grinder should be located near each machine or battery of machines so operators may quickly sharpen cutters to special shapes and also shape styles.

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. We recommend and supply Norton wheels grade Alundum 38-60 BM for general use in grinding cutters for Gorton Duplicators. True up wheel frequently with the diamond dresser, one of which is furnished with each Gorton grinder. Occasionally go over wheels after diamond trueing 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.

Photo 27

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TRADE MARK
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GRINDING SINGLE FLUTE GORTON CUTTERS

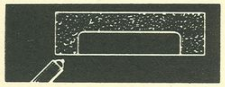

Fig. 1—Trueing Wheel

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.

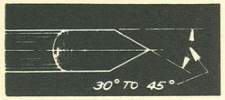

Fig. 2—Set Tool Head to Desired Cutter Angle

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

Set tool head of grinder to angle desired on cutting edge (see Fig. 2). 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. 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.

Fig. 4—Flat not Ground to Center

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.

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.

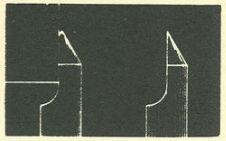

Fig. 5—Grinding Flat to Center

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.

Photo 28

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GRINDING SINGLE FLUTE GORTON CUTTERS

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.

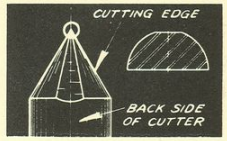

Fig. 6—First Operation in Grinding Clearance

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!*

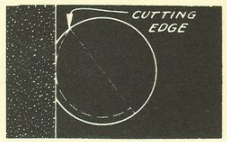

Fig. 7—Second Operation in Grinding Clearance

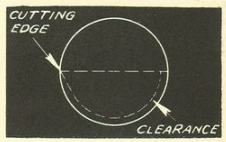

Fig. 8—Section through Cutter after Grinding Clearance

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

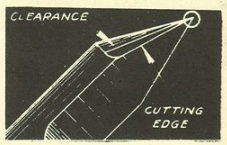

Fig. 9—External View of Fig. 8

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.

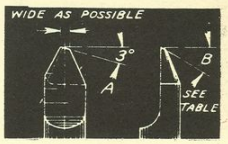

Fig. 10—A "Tipped-off" Cutter

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 29

GRINDING SINGLE FLUTE GORTON CUTTERS

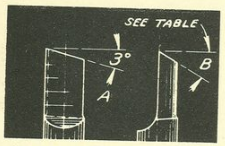

Fig. 11—Square Nose Cutter with Properly Ground Tip

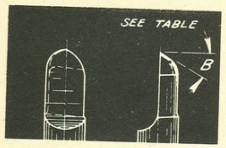

Fig. 12—Properly Ground Ball Nose Cutter

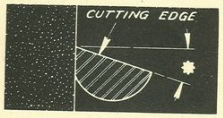

Fig. 13—Tilting Ball Nose Cutter for Clearance

**Use Gauge 9839*

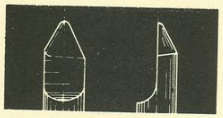

Fig. 14—Ball Nose Cutter with Conical Side

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.

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.

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, and use 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.

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. 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.

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 30

GRINDING THREE and FOUR SIDED CUTTERS

Finish Grinding Chip Clearance on Ball Nose

Now feed cutter toward wheel with knurled micrometer handwheel exactly the amount of clearance in thousands called for in table page 26. Swing the tool head back and forth, using stop 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

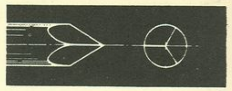

Fig. 15—3-Sided Cutter

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.

SUGGESTIONS ON OPERATION OF CUTTERS

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.

Fig. 16 **Fig. 17** **Fig. 18** **Fig. 19**

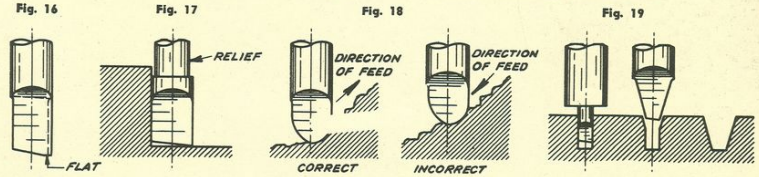

Photo 31

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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.

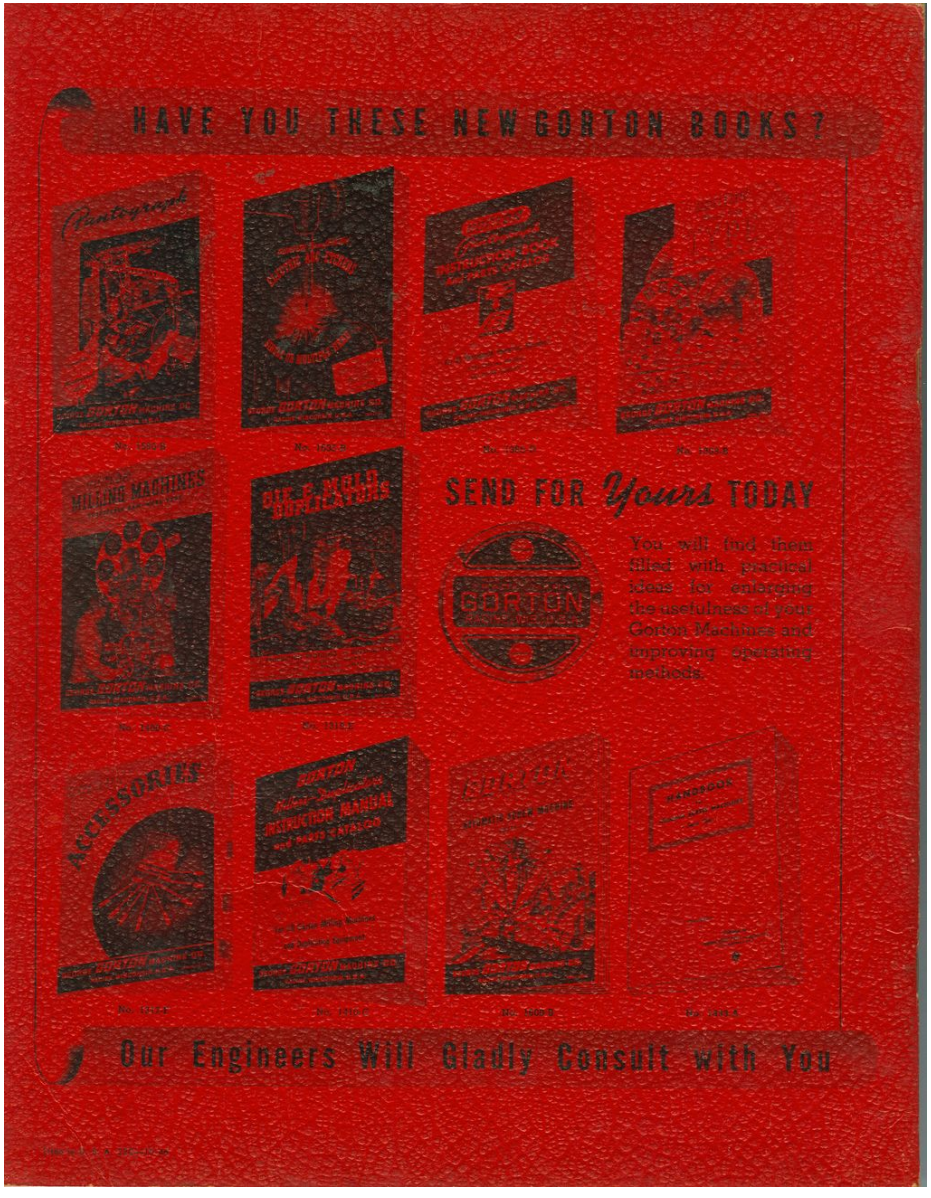
FINISHING CUTS

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 Pantographs and Duplicators, 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 when the cutter is running at maximum efficiency.

Photo 32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Our Engineers Will Gladly Consult with You