

Chandler & Farquhar Co., Inc.

BOSTON 15, MASS.

TEL. LONGWOOD 6-7800

Industrial Tool and Equipment Headquarters

Milling Cutters

Arbors, Adapters and Collets

BROWN & SHARPE

C A T A L O G N O 3 6 C

CONTENTS

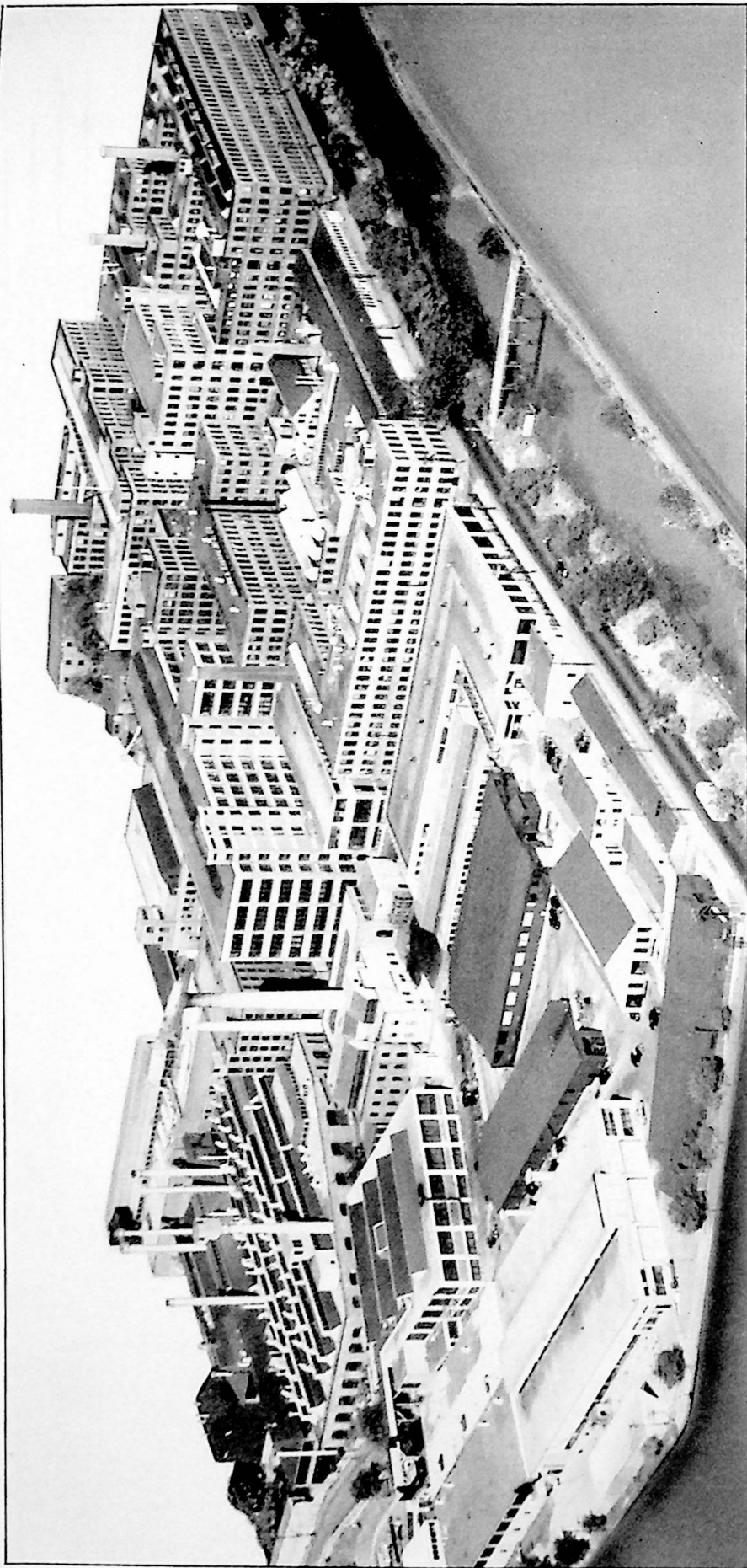
	PAGE
Milling Cutters	5-45
Arbors, Adapters and Collets	46-64
Tables	70-78

In addition to Milling Cutters, Arbors, Adapters and Collets shown in this catalog, the following equipment is listed in Small Tools Catalog No. 35.

- | | |
|--------------------------------|--------------------------------|
| Machinists' Tools | Electronic Measuring Equipment |
| Gages (Plug, Ring and Caliper) | Pumps |
| Johansson Gage Blocks | Other Useful Equipment |
| Screw Machine Tools | |

See Pages 65-69





Main Office and Works of the Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

The main manufacturing buildings and offices have a floor space of 1,434,800 sq. ft., the foundry 311,600 sq. ft. and miscellaneous buildings 151,400 sq. ft. In 1853 the floor space occupied was 1,800 sq. ft. Today, the buildings have over 1,900,000 sq. ft. of floor space—approximately 43½ acres.



1872

B R O W N & S H A R P E

MILLING CUTTERS

ARBORS, ADAPTERS and COLLETS

CATALOG No. 36C



Trade Mark
Reg. U.S. Pat. Off.
and Foreign Countries

IMPORTANT

Prices for the items in this catalog are shown in price list. In ordering, always specify the *Ordering Number* which appears both in this catalog and in separate price list, the name of the item and Catalog No. 36C. This will permit filling your order correctly and save delay and correspondence.

1955

B R O W N & S H A R P E M F G . C O .

PROVIDENCE 1, R.I., U.S.A.

ESTABLISHED 1833

Also Manufacturers of

Milling Machines • Grinding Machines • Screw Machines
Machinists' Tools • Gages • Johansson Gage Blocks
Electronic Production Measuring Equipment
Screw Machine Tools • Pumps
Other Useful Equipment

BROWN & SHARPE MFG. CO.

Main Office and Works: PROVIDENCE 1, R.I., U.S.A.

SALES OFFICES:

BROWN & SHARPE MFG. CO.

Boston Area 1647 Beacon St., Waban 68, Mass.
 West Hartford 7, Conn. 7 South Main St.
 Philadelphia Area 7 Bala Avenue, Bala-Cynwyd, Pa.
 Pittsburgh 27, Pa. 206 Whitehall Center, 4140 Brownsville Road
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BROWN & SHARPE OF NEW YORK, INC.

New York 7, N.Y. 20 Vesey St.
 Rochester 14, N.Y. 1008 Genesee Valley Trust Bldg.
 Syracuse 2, N.Y. 725 University Bldg., 120 East Washington St.

Stocks of Brown & Sharpe Tools are carried by hardware and supply dealers in the principal cities and towns in the United States and by the leading tool dealers in foreign countries.

Of General Interest

THE business now conducted by the Brown & Sharpe Mfg. Co. was founded in 1833 by David Brown and his son Joseph R. Brown. David Brown retired in 1841 and the business was continued by Joseph R. Brown until 1853, when Lucian Sharpe became his partner, and the firm of J. R. Brown & Sharpe was formed. The Brown & Sharpe Mfg. Co. was incorporated in 1868.

The manufacture of Steel Rules and other tools of precision was begun by Joseph R. Brown in 1850. In 1852 a similar line of work was begun by Samuel Darling and, in 1866, the partnership of Darling, Brown & Sharpe was formed, the business being carried on under that name until the partnership was dissolved by the purchase of Mr. Darling's interest in 1892.

All Brown & Sharpe products are made with the intention that they shall be the best in their respective classes. Careful attention is given constantly to insure workmanship of the best quality. Should any defect become apparent in the workmanship of any of our tools, we request that we be notified promptly.

We are pleased to show our works to those who are interested in our products and machine shop practice.

STANDARDS. We make our own Standards which are checked frequently with those of the United States Bureau of Standards, the only standards we recognize.

PATENTS. Many of the items in this catalog are protected by issued or pending United States patents and/or foreign patents.

IMPORTANT. Please address all business communications to the Company. Cable Address "Sharpe Providence." Codes: Our Own and Lieber's.

PURCHASING TOOLS. We urge mechanics and manufacturers to purchase our products from hardware stores and distributors, most of whom carry stocks for the convenience of users of our products. Where tools are not available from dealers they can be purchased directly from our factory.

PRICES. Prices are subject to change without notice. In addition to stated prices, buyer shall pay the seller an amount equal to any sales, use, occupation or excise taxes which the seller may pay in respect to a sale. Prices F.O.B. Providence, R.I.

Discounts: A dealers' discount is allowed to legitimate hardware and supply stores. This discount will be given on application.

TRANSPORTATION. We do not pay transportation costs or duties on shipments of goods to dealers *except* on CUTTERS and Ground Flat Stock.

On shipments of Cutters and Ground Flat Stock we allow minimum transportation charges on orders having a net value of \$25.00 or more each.

TERMS OF PAYMENT—UNITED STATES AND CANADA. **Mechanics:** Where our small tools cannot be obtained from dealers we pay transportation charges from our factory to any place in the United States and Canada, and will ship upon receipt of remittance in New York funds for the price of tools. We do not pay duty on shipments outside the United States.

Manufacturers and Dealers: Net 30 days to firms of approved credit. We do not pay duty on shipments outside the United States.

ORDERING. Use the price list in ordering. Always specify the ORDERING NUMBER which appears both in the catalog and in the price list, the name of the item desired and Catalog No. 36C. All verbal instructions should be confirmed in writing.

Orders are subject to delays occasioned by strikes, fires, floods, accidents or by any cause beyond our control, including delivery of material to us.

DELIVERY. F.O.B. Providence, R.I. Title and right of possession will pass to customer upon delivery to carrier at Providence, R.I.

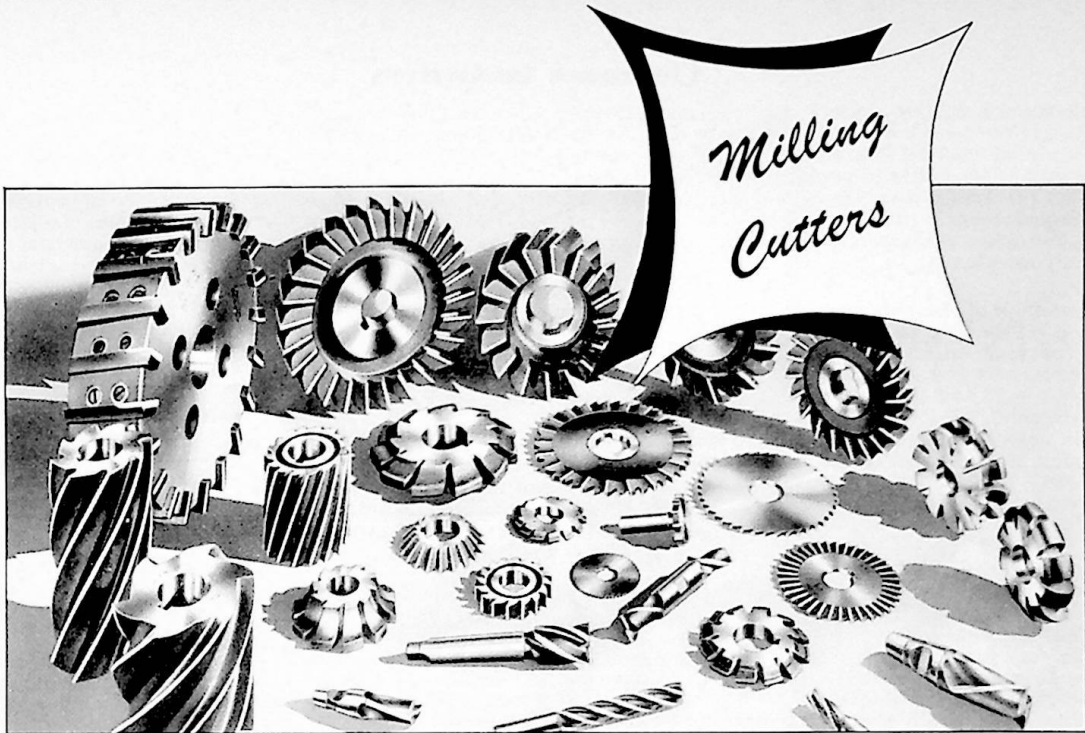
SHIPPING INSTRUCTIONS. State distinctly in giving shipping instructions, whether goods are to be sent by freight, express or mail. When instructed to ship by mail, we assume it is desired to ship by parcel post, insured. If no shipping instructions are given we will ship the way we consider best, taking into account the factors of economy, time of delivery and safety, and in such cases we cannot be held responsible for transportation charges, delays or loss in transit.

CLAIMS. Although goods are considered sold and our responsibility ceases when delivery is made to post office or transportation company, in event of goods being lost in transit, we will make every effort in behalf of customer to have lost goods found or to have the post office or transportation company make proper restitution for loss.

RETURNING GOODS. If for any reason goods are returned, the transportation charges must be paid and we particularly request in such cases that the name and address of the sender be marked plainly on the package. Always send a letter of explanation at the same time.

SPECIAL ORDERS. In ordering special tools, be sure to give full information, sketches and dimensions. While special tools often are required, we wish to impress on customers the advantage of ordering, if possible, goods that are carried in stock instead of goods that vary only slightly from stock articles and have to be made to order.

FOR DEALERS. We have available for the use of dealers regularly selling our products display material, booklets, circulars and other selling aids as well as electrotypes for advertising and catalog purposes. This material furnished upon request.



The sizes of cutters listed in this catalog are in accordance with Simplified Practice Recommendation endorsed by the U. S. Department of Commerce and are carried in stock regularly.

THE value of a milling cutter is determined by the rate it can produce, by the accuracy with which it can duplicate a required part and by the number of pieces it can produce per sharpening. To be able to fulfill one or all of these outstanding requirements, a cutter must be made correctly, it must be dependable and it must be long-lived.

Brown & Sharpe Cutters fulfill all of these requirements. They are made correctly, they are dependable, highly productive and long-lived. Over 90 years of experience contributes to the excellence of these cutters. In addition, thousands of cutters are in daily use in our own plant and so from actual cutter operations are determined the designs of cutters, types of steels and carbides used in their manufacture and the heat treat-

ments best suited for different classes of work. This, in no small measure, is responsible for the fine performances of Brown & Sharpe Cutters which result in the lowest real cutter cost for their users.

In addition to the cutters shown in this catalog, we can make cutters of any size or shape or furnish any combination of cutters.

Stocks of cutters are carried by leading hardware and supply dealers throughout the country and usually can be purchased most advantageously from them. Special cutters, also, can be ordered advantageously from dealers as they are in a position to give prompt and efficient service to their customers.

Keep Cutters Sharpened Properly

A sharp cutter gives a better finish than a dull one and with greater accuracy, less power consumption and less strain on the machine. A sharp cutter wears much longer and less stock has to be ground off to restore the cutting edge than is necessary if the cutter is allowed to become dull. A sharp cutter, also, increases the efficiency of production.

Cutters that are kept in good condition by frequent re-sharpenings will invariably outlast cutters that are permitted to become worn and dull. This saving, together with the better results obtained through the use of sharp cutters, more than compensates for the time spent in sharpening.

Experience is required to determine when a cutter has reached the point where sharpening is desirable. This, however, is soon acquired if the cutters are observed closely. A practice sometimes followed with satisfaction, where parts are being milled in large quantities, is to establish a length of time for which the cutters can be operated safely between sharpenings and to then adhere to this sharpening schedule without checking the condition of the cutters. Formed cutters with radial teeth should have their teeth ground radially. Formed cutters with teeth cut back of center should have their teeth sharpened with the amount of rake marked on the cutters. Further information on page 38.

In sharpening Brown & Sharpe Spiral End Mills and Two

Lipped Spiral End Mills the double angle lands with which these mills are furnished should be preserved. These double



angle lands permit the correct cutting clearance to be maintained with a strong tooth shape.

In sharpening the end teeth of Spiral End Mills under $\frac{1}{4}$ " in diameter, either a straight wheel can be used as shown in Fig. 1 or a cup wheel as shown in Fig. 2. Wheels should be set to give approximately 4° cutting clearance and sufficient concavity to make the points of the teeth higher than any other part. Should repeated sharpenings eliminate the center hole, the efficiency of the end mill is not impaired.

Clearance on Cutters

When sharpening milling cutters, the clearance always should be taken into consideration. Clearance, or relief, is the amount of material removed from the top of the teeth back of the cutting edge of the cutter to permit the teeth to clear the stock and not rub over it after the cutting edge has done its work. On formed and gear cutters, clearance is not affected by resharping because, in sharpening such cutters, the faces of the teeth only are ground.

The proper angle of clearance depends upon the diameter of the cutters as well as upon the material to be milled, and must be greater for small cutters than for large ones. The recommended clearance on the teeth of plain milling cutters $\frac{1}{8}$ " to 3" in diameter is 13 to 5 degrees respectively and on cutters over 3" in diameter, 4 degrees. The clearance of the end teeth of end mills, except two lipped end mills, should be about 4 degrees and it is well to have the teeth slightly concave, removing .001" to .002" more near the center than at the outside, so that the inner ends of the teeth will not drag on the

work. The clearance of the end teeth of two lipped end mills is about 7 degrees.

Another factor that must be considered in the clearance on cutters is the maintenance of the proper width of land. In general, the width of land on new cutters is approximately $\frac{1}{32}$ " to $\frac{1}{16}$ ". When repeated sharpening increases the land to such a width as to exceed the limits named above, the heel or back end of the tooth may be ground off to bring the land to its original width.

Below is a table of clearances for cutters of various diameters. These clearance angles are for use when cutting cast iron or steel. Larger clearance angles are desirable on such materials as aluminum, brass, copper and most non-metallic materials.

Cutter Diam.	Clearance Angle	Cutter Diam.	Clearance Angle	Cutter Diam.	Clearance Angle
$\frac{1}{8}$ "	13°	$\frac{5}{16}$ " to $\frac{3}{8}$ "	9°	$1\frac{1}{8}$ " to 2"	6°
$\frac{3}{32}$ " to $\frac{3}{16}$ "	11°	$\frac{7}{16}$ " to $\frac{9}{16}$ "	8°	$2\frac{1}{4}$ " to 3"	5°
$\frac{1}{32}$ " to $\frac{1}{4}$ "	10°	$\frac{5}{8}$ " to 1"	7°	$3\frac{1}{2}$ " up	4°

Cutting Lubricants

Cast iron and bronze are usually cut dry, but cutting oils and compounds are used in cutting steels.

Cutting oils are used mainly on work when a good finish is desired. These oils vary in composition, there being many different types. In general they should be fairly clean and have no corrosive action or objectionable odors.

Sulphur base oils generally give good finishes—the finish being improved by increasing the amount of sulphur. However, this type of oil has disadvantages in that it is apt to corrode copper and brass and often times steel.

Lard oil has long been used as a cutting oil and is still used extensively for cutting threads. It is used also in varying percentages in many present day cutting oils.

The cutting emulsions consist of water and various percentages of soluble oil. The addition of soluble oil primarily acts as a rust preventive. However, by increasing the percentage of oil an improvement in finish is obtained. Emulsions are better coolants than oils and, therefore, are used when cooling is more desirable than finish. A commonly used emulsion is one part of soluble oil to twenty-five parts of water.

Speeds and Feeds for Milling Cutters

The proper speeds and feeds are fundamental for the best performance of milling cutters. While no exact figures can be given applying to all operating conditions and grades of materials, it is possible to indicate the general principles applying to the setting of speeds and feeds for initial setups. The figures in the following tables represent speeds and feeds recommended by the Milling Cutter Division of the Metal Cutting Tool Institute.

Speeds

Peripheral speeds of milling cutters should always be figured on the basis of surface feet per minute (sfm) rather than revolutions per minute (rpm).

In general, surface speeds of milling cutters should be in inverse proportion to the hardness of the material to be milled. Soft materials can be milled at high speeds, while hard materials call for low speeds.

The following table giving surface feet per minute can be used as a starting point for milling cutter speeds in various materials:

Material to be Milled	Milling Cutter Materials		
	High Speed Steel	Cast Cutting Alloys	Cemented Carbides
Aluminum and Magnesium	600 up		1000 up
Copper	500 up		1000 up
Brass—Soft	500 up		1000 up
—Hard	200	300	400
Bronze	200	300	400
Malleable Iron	100	200	350
Cast Iron—Soft	100	130	275
—Medium	75	110	250
—Hard	50	90	200
Cast Steel	70	100	200
Steel—100 Brinell	150	200	500
—150 Brinell	100	200	450
—200 Brinell	70	180	400
—250 Brinell	60	175	350
—300 Brinell	45		300
—350 Brinell	35		250
—400 Brinell	30		200
Stainless Steel	50		400

Reduce Speeds for: hard materials; abrasive materials; deep cuts; high alloy content.

Increase Speeds for: soft materials; better finishes; light cuts; frail work pieces and setups; fine pitch thread milling.

Feeds

The most economical operation calls for a substantial feed per tooth.

Assuming that the ideal feed per tooth for a given job has been determined, it would appear that the feed per minute would depend on the number of teeth in the cutter and that the higher this number of teeth, the higher the rate of production would be.

Unfortunately, there are two reasons why this does not always work out in actual everyday use:—

1. Too many teeth will result in chatter, this tendency increasing with greater depth of cut and also with wider cuts.

2. When doing a finish milling operation, the feed per revolution is frequently limited by the quality of finish demanded. A high number of teeth would then result in the feed per tooth becoming inefficiently small.

Because of these considerations, Coarse-Tooth Milling Cutters or Helical Plain Milling Cutters are usually recommended in preference to cutters having a greater number of teeth.

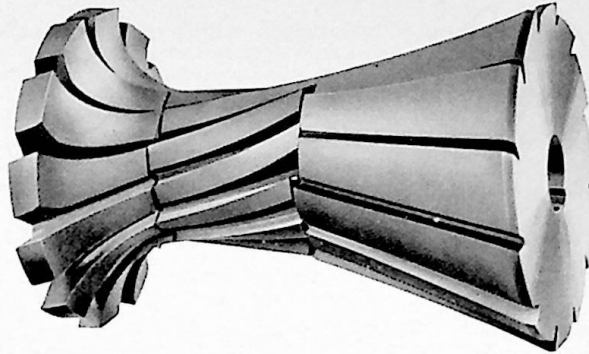
The following table of suggested feeds should prove of value in setting up initial jobs:

Type of Cut	Starting Feed per Tooth, Inches
Face Milling	.008
Straddle Milling	.008
Channel or Slot Milling	.008
Slab Milling	.007
End Milling or Profiling	*.004
Sawing	.003
Thread Milling	.002

*For end mills smaller than $\frac{1}{2}$ inch diameter, feeds per tooth must be much lower than the figure given.

Rigid setups, soft materials and shallow cuts permit heavier feeds, while frail setups, deep slots, stringy materials and high finish requirements call for lower feeds per tooth.

Special Cutters



Three piece Formed Cutter, 9 inches in diameter and 13½ inches long. Outside sections have angular gashes, center section has spiral gashes with rake.



End Mill 1¾ inches in diameter and 18 inches in over-all length. Has 6 teeth with hollow faces and a 30° spiral.

In manufacturing quantities of duplicate parts of irregular shape or form, it is often of great advantage to use cutters designed especially for the particular job. Special cutters of the formed type are selected frequently for such jobs as they provide substantial economies in the milling costs. Many times, however, when the shape or form of the piece is simple, special cutters can be used which are not of the formed type but are similar in design to stock cutters varying only in length, diameter or number of teeth.

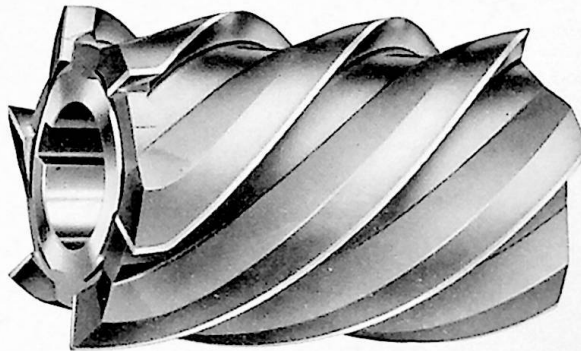
In addition to Special Cutters of the formed type, we have designed many other cutters for practically all types of milling

requirements where accuracy, dependability and long life are required. We have developed cutters to meet unusually difficult conditions imposed by the hardness and chemical properties of the piece being milled. Also, we have designed cutters for highly specialized purposes and unusual requirements which have satisfactorily done work for which no other practical machining method was available.

Brown & Sharpe Special Cutters provide accurate reproduction of forms at a high rate of production. Their design, construction and heat treatment are based on knowledge and experience accumulated over many years of cutter manufacture.

Helical Plain Milling Cutters with End Teeth

Hole Type

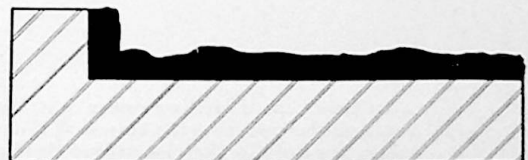


Helical Plain Milling Cutters with End Teeth have all the advantages of Helical Plain Milling Cutters, plus the added advantage of being suitable for use in places where a shoulder must be produced at one end of the cut.

These cutters are similar in construction to regular helical milling cutters except that the spiral angle is decreased at one end, permitting the forming of strong end teeth.

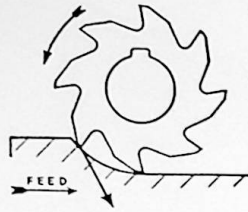
Helical Plain Milling Cutters with End Teeth can be furnished to order with either right- or left-hand spiral and having end teeth with square, chamfered or rounded corners.

In ordering, specify hand of spiral and type of end teeth desired.

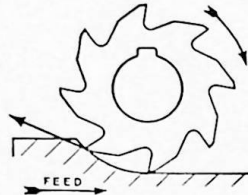


With a Helical Plain Milling Cutter with End Teeth an end cut and a slabbing cut, as shown above, are made at the same time with one pass of the cutter.

Climb Milling



Climb Milling



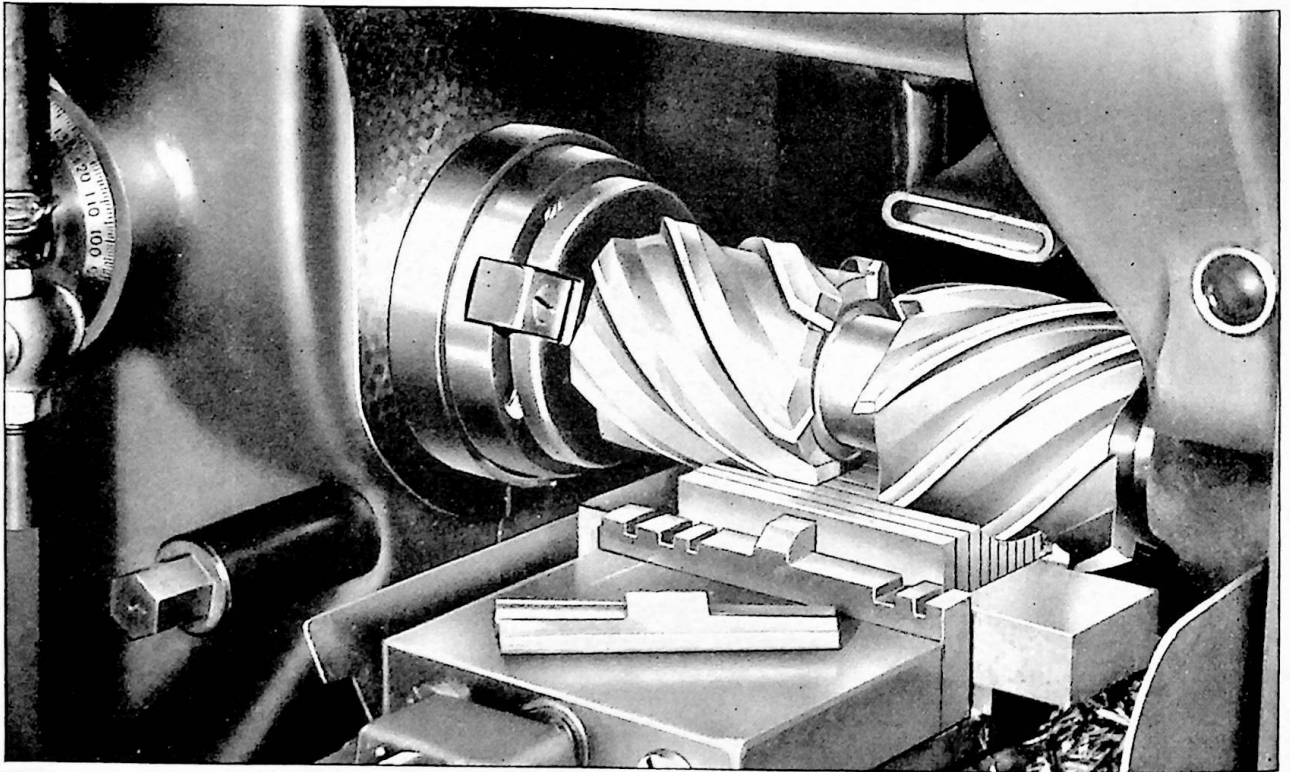
Conventional Milling

Climb milling differs from conventional milling in that the work is fed in the same direction as the movement of the cutter teeth rather than against the movement of the teeth.

Climb milling can be used advantageously on many kinds of work to increase the number of pieces per sharpening and to produce a better finish. Its employment permits increased production, as a milling operation can be performed at each end of the machine table permitting loading and unloading of one fixture while the cutters engage the work held in the other fixture. With climb milling, saws cut long thin slots more satisfactorily than with conventional milling. Also, work can be held more securely as the cutter itself tends to force the work into the clamping fixture and against the table, a feature especially desirable when milling thin flat pieces.

Stock cutters can be used for both climb and conventional milling except when climb milling soft steel of low carbon content. For work of this class, special cutters made with a large amount of rake and a steep spiral angle are required to produce a good finish. When ordering, complete details of operations to be performed should be given including the analysis of the material and amount of stock to be removed. Climb milling is not recommended ordinarily for use on cast iron or forgings.

Because of the tendency of the cutters to pull the work forward in climb milling, milling machines designed with special features adapting them for climb milling are essential to the success of this operation. Light climb milling cuts, however, may be taken on machines not designed for climb milling, provided means can be found to prevent the table from being pulled forward by the cutting action of the cutters.



In this Climb Milling operation, seven rectangular pieces with rounded bottom edges are held in the vise at one time and two cuts $2\frac{1}{4}$ " x $\frac{5}{8}$ " are taken in each piece at each pass of the cutters. The

cutting action of Climb Milling forces the work downward into the vise, permitting seven pieces to be milled at one time in a simple fixture at a fast rate of feed.



Carbide Cutters

Brown & Sharpe through its Cutter Engineering Department has obtained authoritative and intimate knowledge of carbide cutting tools from actual carbide cutter manufacture and operation as well as from extensive experimentation and tests. Investigations of cutting angles, of varied speeds and feeds, and of different types of carbides on different materials have been conducted on especially equipped testing equipment with various recording devices.

The knowledge acquired on carbides, assures users of Brown & Sharpe Carbide Milling Cutters of superior and outstanding performance.

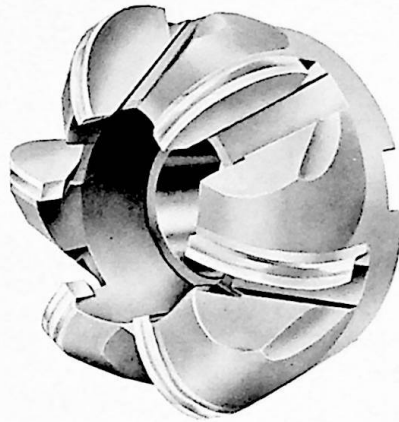
Carbide cutters are usually of the profile sharpened type and include such items as:

- | | |
|---------------------------|---------------------------------|
| Face Milling Cutters | Staggered Tooth Milling Cutters |
| Shell End Mills | Side Milling Cutters |
| Side Milling Cutters | End Mills |
| Half Side Milling Cutters | Saws |

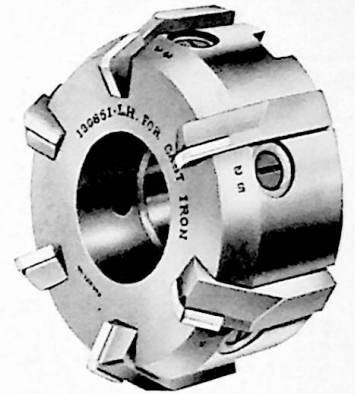
In ordering carbide cutters, as complete information as possible as to cutter and material and any pertinent work conditions should be included to make possible the development of the most advantageous design.



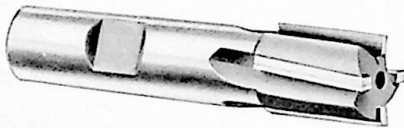
Carbide Milling Cutter for machining bevel on type metal plates. Plates are hot at time of machining.



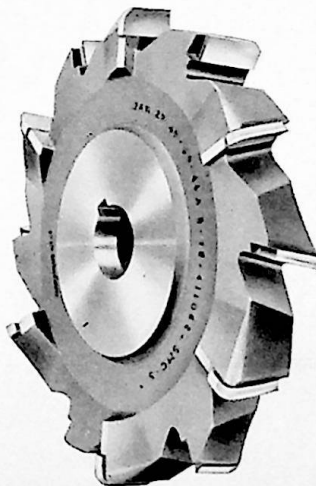
Carbide Tipped Shell End Mill with large corner radius. Used to mill root diameter and blend radius with side of screw on large screw type conveyor.



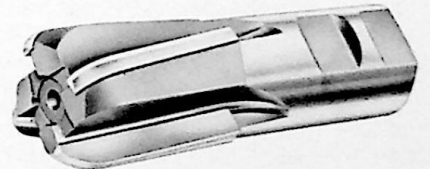
Inserted Tooth Shell End Mill with carbide tipped blades for general purpose use on cast iron. Radial and axial rake angles are zero degrees. Bevel angle shown is 30°.



Carbide Tipped End Mill made with non-magnetic body and tool steel shank to prevent magnetized chips from adhering to the cutter.

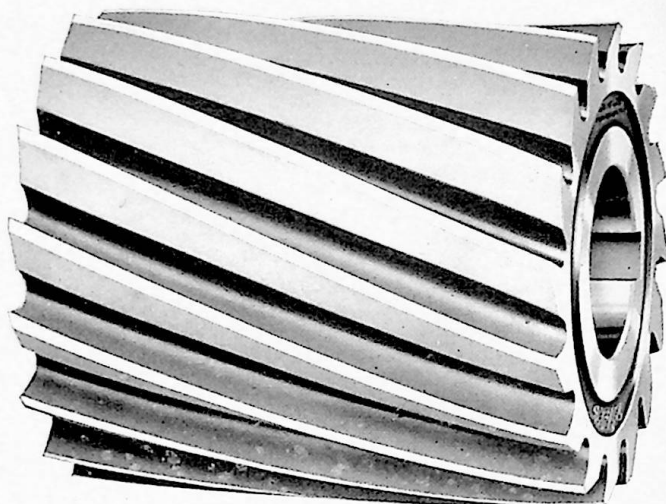


Carbide Staggered Tooth Side Milling Cutter. Wherever possible, in cutters with carbide teeth, it is advisable to substitute chamfers and radii for sharp corners.



Carbide Tipped End Mill. Note long cutting teeth and large partial radius used to blend with cut made by previous operation.

Plain Milling Cutters



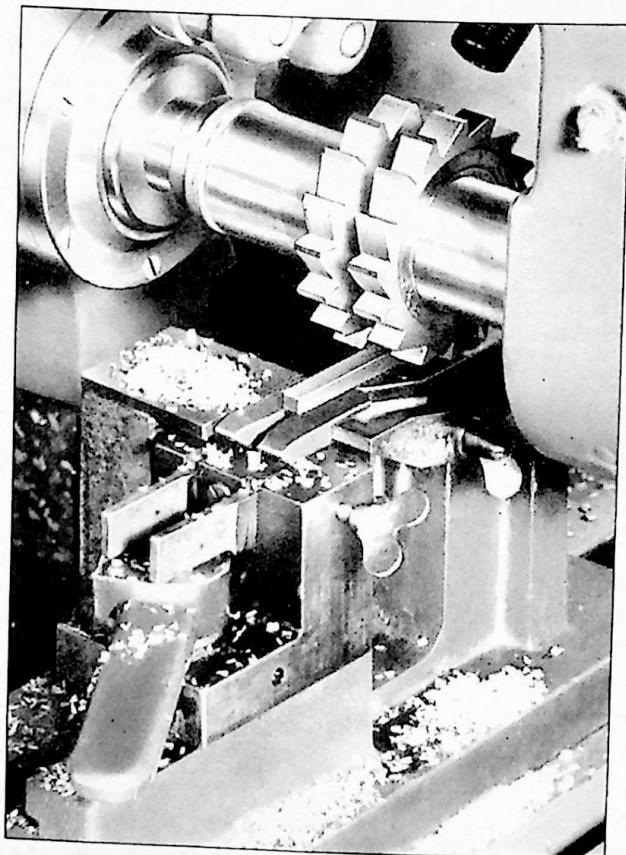
Cutters of less than $\frac{3}{4}$ " face have straight teeth.
Cutters of $\frac{3}{4}$ " face and over have spiral teeth.

Diameter, Inches	Width of Face, Inches	Hole, Inches	No. of Teeth	Order by Number	Old Catalog Number
2¼	½	⅞	16	705-10-10	M-10
2¼	1	⅞	16	705-10-11	M-11
2½	⅜	1	16	705-10-14	M-14
2½	¼	1	16	705-10-15	M-15
2½	⅝	1	16	705-10-16	M-16
2½	⅜	1	16	705-10-17	M-17
2½	⅞	1	16	705-10-18	M-18
2½	½	1	16	705-10-19	M-19
2½	⅝	1	16	705-10-21	M-21
2½	¾	1	16	705-10-23	M-23
2½	1	1	16	705-10-26	M-26
2½	1½	1	16	705-10-29	M-29
2½	2	1	16	705-10-31	M-31
2½	2½	1	16	705-10-33	M-33
2½	3	1	16	705-10-35	M-35
3	⅜	1	16	705-10-61	M-61
3	¼	1	16	705-10-62	M-62
3	⅝	1	16	705-10-63	M-63
3	⅜	1	16	705-10-63-1	M-63A
3	⅞	1¼	16	705-10-64	M-64
3	⅞	1¼	16	705-10-65	M-65
3	½	1¼	16	705-10-66	M-66
3	⅝	1¼	16	705-10-68	M-68
3	¾	1¼	16	705-10-70	M-70
3	⅞	1¼	16	705-10-71	M-71
3	1	1¼	16	705-10-72	M-72
3	1¼	1¼	16	705-10-73	M-73
3	1½	1¼	16	705-10-74	M-74
3	2	1¼	16	705-10-76	M-76
3	3	1¼	16	705-10-78	M-78
4	¼	1	18	705-10-101-1	M-101A
4	¼	1¼	18	705-10-105	M-105
4	⅝	1	18	705-10-101-2	M-101B
4	⅝	1¼	18	705-10-106	M-106
4	⅜	1	18	705-10-101-3	M-101C
4	⅜	1¼	18	705-10-107	M-107
4	½	1¼	18	705-10-109	M-109
4	⅝	1¼	18	705-10-112	M-112
4	¾	1¼	18	705-10-111	M-114
4	1	1¼	18	705-10-117	M-117
4	1½	1¼	18	705-10-121	M-121
4	2	1¼	18	705-10-125	M-125
4	3	1¼	18	705-10-123	M-128
4	4	1¼	18	705-10-130	M-130

List of Keyways, page 32.

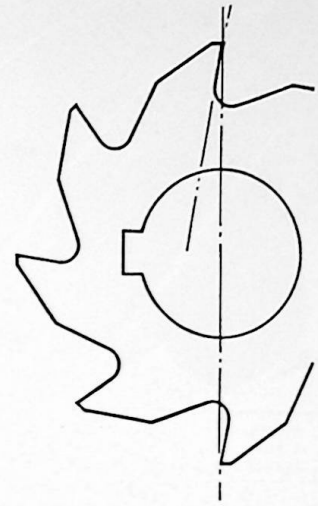
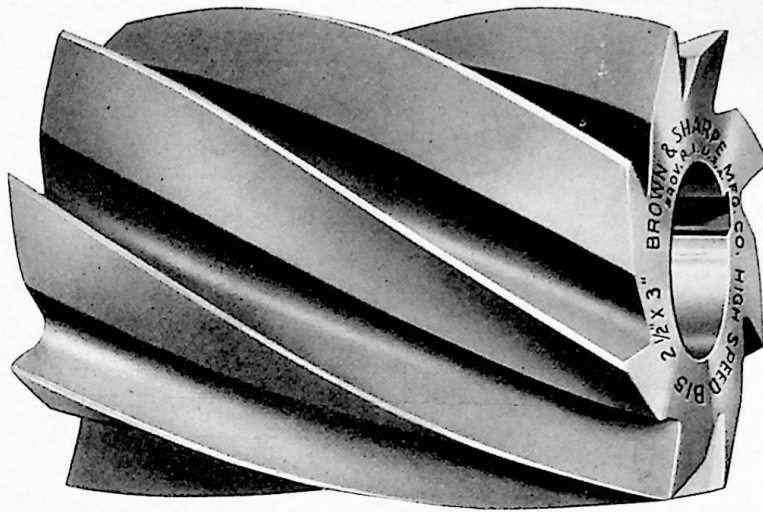
Packed one in a box.

For Prices, See Separate Section



Here, two Plain Milling Cutters are being used to mill simultaneously surfaces of two prongs of a sewing machine part placed in a holding fixture with aligning key, providing a very satisfactory rate of production. Plain Milling Cutters, with narrow widths of face and with slight concavity on the sides, also have widespread use for cutting keyways and slots.

Coarse-Tooth Milling Cutters

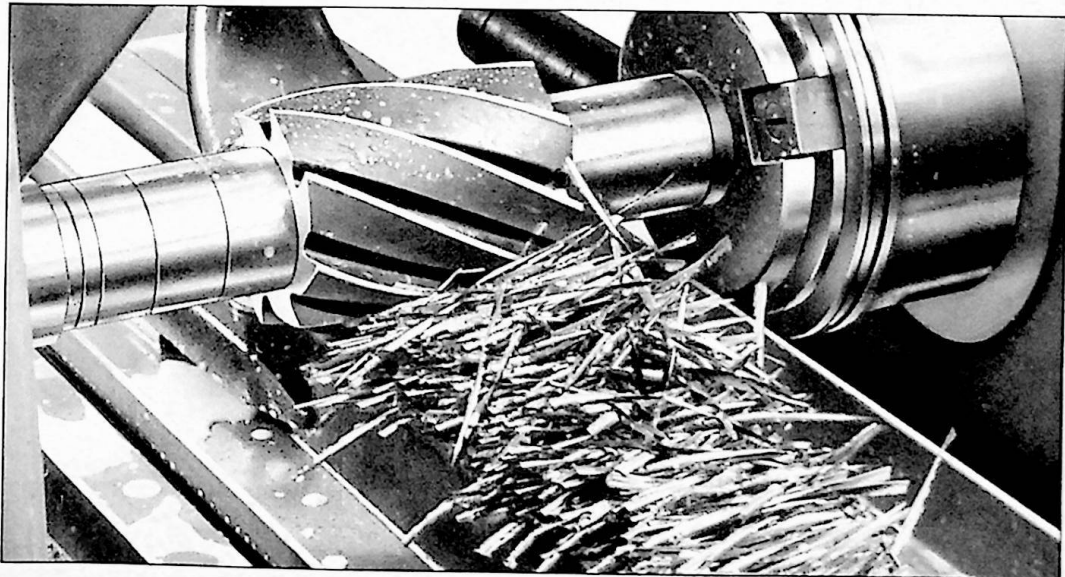


Diameter, Inches	Width of Face, Inches	Hole, Inches	No. of Teeth	Order by Number	Old Catalog Number
2 1/2	2	1	8	705-10-254	M-254
2 1/2	4	1	8	705-10-257	M-257
3	2	1 1/4	8	705-10-261	M-261
3	2 1/2	1 1/4	8	705-10-262	M-262
3	3	1 1/4	8	705-10-263	M-263
3	4	1 1/4	8	705-10-264	M-264
3	6	1 1/4	8	705-10-266	M-266
4	2	1 1/2	10	705-10-278	M-278
4	3	1 1/2	10	705-10-279	M-279
4	4	1 1/2	10	705-10-280	M-280
4	6	1 1/2	10	705-10-282	M-282
4 1/2	6	2	10	705-10-288	M-288

List of Keyways, page 32.

Packed one in a box.

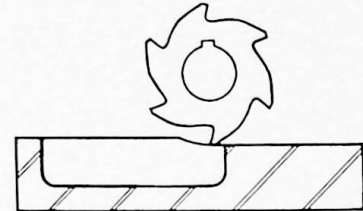
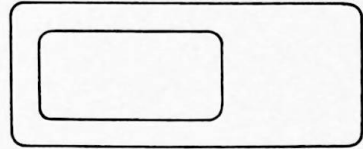
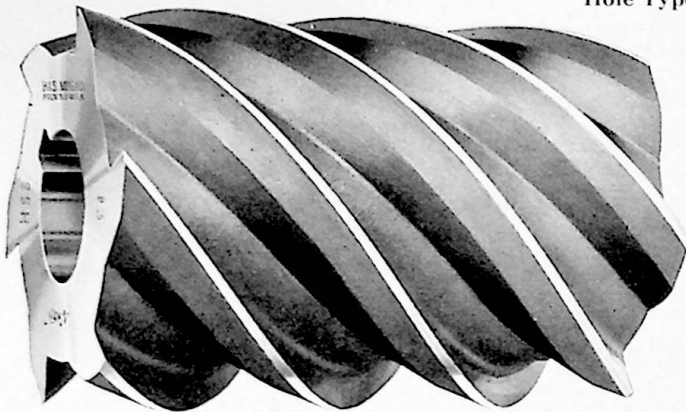
The strong, widely spaced teeth and ample chip space of Coarse-Tooth Milling Cutters permit the rapid removal of stock at average depths. The size of the chips and their shape shown in the illustration below indicate the efficiency of this cutter for such operations.



For Prices, See Separate Section

Helical Plain Milling Cutters

Hole Type



Diameter, Inches	Width of Face, Inches	Hole, Inches	No. of Teeth	Order by Number	Old Catalog Number
3	4	1 1/4	4	705-10-300	M-300
3	6	1 1/4	4	705-10-302	M-302
4	4	1 1/2	6	705-10-306	M-306
4	6	1 1/2	6	705-10-308	M-308
4	8	1 1/2	6	705-10-310	M-310
4	10	1 1/2	6	705-10-312	M-312

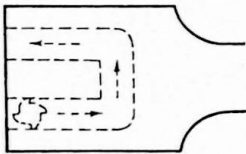
List of Keyways, page 32.

Packed one in a box.

Especially proficient in taking slabbing cuts, producing a fine finish without chatter. They can be used to particular advantage in removing an uneven amount of stock without gouging, as shown above.

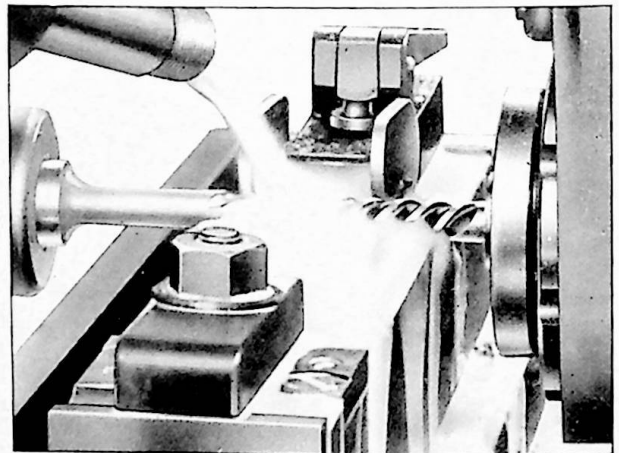
Helical Plain Milling Cutters

Arbor Type



For internal finishing, working either from a drilled hole or directly in from the end of the piece. Illustration shows cutter working directly into the solid metal to form the forked end. The steep spiral gives the mill a shearing action that enables the cut to be taken easily while maintaining a good finish. The undercut teeth contribute to the free cutting action.

Made to customers' needs in any size and for any method of driving.

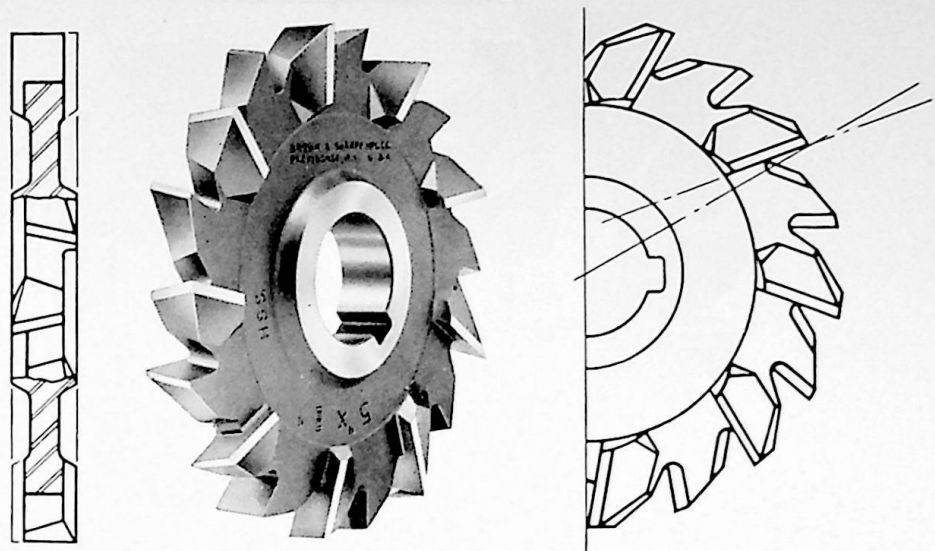


The reduced number of teeth and steep angle of spiral of Helical Plain Milling Cutters (Arbor Type) permit their use for deep slabbing cuts while providing a fine finish without chatter. Used where depth of cut would make impracticable employment of a cutter with a lesser angle of spiral.

Helical Plain Milling Cutters (Arbor Type) because of the steep spiral of angle of cutting teeth, permit the cutter to be fed directly into a slot or even solid metal. Like the Hole Type Helical Plain Milling Cutter, they cut freely and maintain a good finish.

For Prices, See Separate Section

Staggered Tooth Side Milling Cutters



The diagrams above show the structure of the teeth and the undercutting which give an improved shearing action.

Because of the alternate right- and left-hand spiral angles of the teeth, with considerable angle of undercut, these cutters can remove a large amount of metal without destructive vibration and chatter, taking deep cuts with a good finish. The free cutting action makes possible an increased speed and feed—

cuts can be taken easily that would stall an ordinary cutter. While intended primarily for deep cuts in steel, cutters will operate on shallow cuts, an advantage if the work requires cuts of varying depths. They are held to very close limits for cutting standard slots or keyways.

Frequently Staggered Tooth Side Milling Cutters are used in pairs as interlocking cutters. If cutters are to be used in this manner, specify when ordering.

Diameter, Inches	Width of Face, Inches	Hole, Inches	No. of Teeth	Order by Number	Old Catalog Number
2½	¼	⅞	14	705-10-350	M-350
2½	⅜	⅞	14	705-10-351	M-351
2½	⅝	⅞	12	705-10-352	M-352
2½	¾	⅞	12	705-10-353	M-353
3	⅜	1	16	705-10-358	M-358
3	½	1	16	705-10-359	M-359
3	⅝	1	16	705-10-360	M-360
3	¾	1	14	705-10-361	M-361
3	⅞	1¼	14	705-10-363	M-363
3	1	1¼	14	705-10-365	M-365
3	1¼	1¼	14	705-10-367	M-367
4	¼	1¼	18	705-10-370	M-370
4	⅜	1¼	18	705-10-371	M-371
4	½	1¼	18	705-10-372	M-372
4	⅝	1¼	16	705-10-373	M-373
4	¾	1¼	16	705-10-374	M-374
4	⅞	1¼	16	705-10-376	M-376
4	1	1¼	16	705-10-378	M-378
4	1¼	1¼	16	705-10-380	M-380
5	½	1¼	18	705-10-382	M-382
5	⅝	1¼	18	705-10-384	M-384
5	¾	1¼	18	705-10-386	M-386
6	⅜	1¼	24	705-10-390	M-390
6	½	1¼	24	705-10-392	M-392
6	⅝	1¼	20	705-10-394	M-394
6	¾	1¼	20	705-10-396	M-396
6	⅞	1¼	20	705-10-398	M-398
6	1	1¼	20	705-10-399	M-399
8	⅜	1½	24	705-10-410	M-410
8	½	1½	24	705-10-412	M-412
8	⅝	1½	24	705-10-414	M-414
8	¾	1½	24	705-10-416	M-416



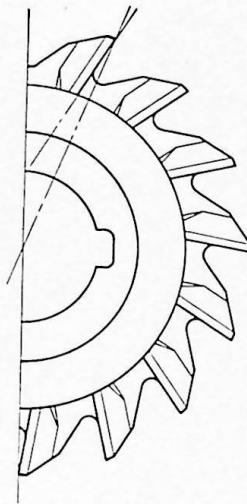
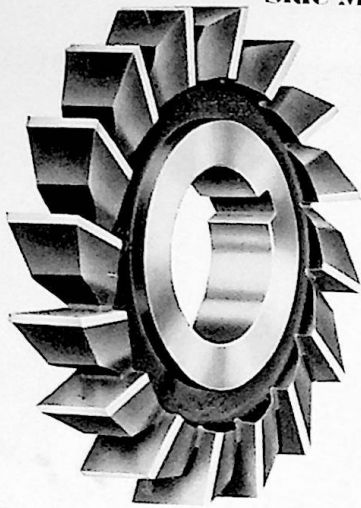
Staggered Tooth Side Milling Cutters with their alternate right-hand and left-hand spiral angles and deep angle of undercut provide a free cutting action that permits their employment for deep cuts which would stall an ordinary cutter. The illustration shows a typical example of deep slotting with the cutting efficiency indicated by the chips.

List of Keyways, page 32.

Packed one in a box.

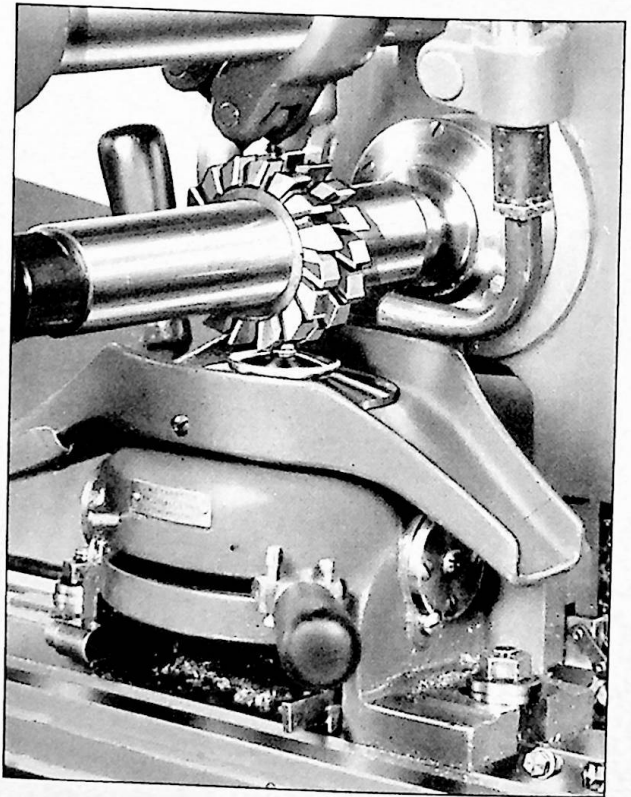
For Prices, See Separate Section

Side Milling Cutters



Diameter, Inches	Width of Face, Inches	Hole, Inches	No. of Teeth	Order by Number	Old Catalog Number
2	$\frac{3}{16}$	$\frac{1}{2}$	14	705-50-10	S-10
2	$\frac{1}{4}$	$\frac{1}{2}$	14	705-50-11	S-11
2	$\frac{3}{8}$	$\frac{1}{2}$	14	705-50-12	S-12
2	$\frac{3}{16}$	$\frac{5}{8}$	14	705-50-13	S-13
2	$\frac{1}{4}$	$\frac{5}{8}$	14	705-50-14	S-14
2	$\frac{3}{8}$	$\frac{5}{8}$	14	705-50-15	S-15
2 $\frac{1}{2}$	$\frac{1}{4}$	$\frac{7}{8}$	16	705-50-16	S-16
2 $\frac{1}{2}$	$\frac{5}{16}$	$\frac{7}{8}$	16	705-50-17	S-17
2 $\frac{1}{2}$	$\frac{3}{8}$	$\frac{7}{8}$	16	705-50-18	S-18
2 $\frac{1}{2}$	$\frac{1}{2}$	$\frac{7}{8}$	16	705-50-20	S-20
3	$\frac{1}{4}$	1	16	705-50-26	S-26
3	$\frac{5}{16}$	1	16	705-50-27	S-27
3	$\frac{3}{8}$	1	16	705-50-28	S-28
3	$\frac{7}{16}$	1	16	705-50-29	S-29
3	$\frac{1}{2}$	1	16	705-50-30	S-30
4	$\frac{1}{4}$	1	18	705-50-34-1	S-34A
4	$\frac{3}{8}$	1	18	705-50-34-2	S-34B
4	$\frac{1}{2}$	1	18	705-50-35	S-35
4	$\frac{1}{2}$	1 $\frac{1}{4}$	18	705-50-35-1	S-35A
4	$\frac{5}{8}$	1	18	705-50-36	S-36
4	$\frac{5}{8}$	1 $\frac{1}{4}$	18	705-50-38	S-38
4	$\frac{3}{4}$	1	18	705-50-39	S-39
4	$\frac{3}{4}$	1 $\frac{1}{4}$	18	705-50-39-1	S-39A
4	$\frac{7}{8}$	1	18	705-50-40	S-40
4	$\frac{7}{8}$	1 $\frac{1}{4}$	18	705-50-40-1	S-40A
5	$\frac{1}{2}$	1	20	705-50-40-2	S-40B
5	$\frac{1}{2}$	1 $\frac{1}{4}$	20	705-50-40-3	S-40C
5	$\frac{3}{4}$	1	20	705-50-41	S-41
5	$\frac{3}{4}$	1 $\frac{1}{4}$	20	705-50-42	S-42
5	$\frac{5}{8}$	1	20	705-50-42-1	S-42A
5	$\frac{5}{8}$	1 $\frac{1}{4}$	20	705-50-42-2	S-42B
6	1	1 $\frac{1}{4}$	20	705-50-44-1	S-44A
6	$\frac{1}{2}$	1	22	705-50-44-2	S-44B
6	$\frac{1}{2}$	1 $\frac{1}{4}$	22	705-50-44-3	S-44-3
6	$\frac{3}{8}$	1 $\frac{1}{4}$	22	705-50-44-4	S-44-4
6	$\frac{3}{4}$	1	22	705-50-45	S-45
6	$\frac{3}{4}$	1 $\frac{1}{4}$	22	705-50-45-1	S-45A
6	1	1 $\frac{1}{4}$	22	705-50-47-2	S-47B
7	$\frac{3}{4}$	1 $\frac{1}{4}$	24	705-50-47-3	S-47C
7	1	1 $\frac{1}{4}$	24	705-50-48	S-48
8	$\frac{3}{4}$	1 $\frac{1}{4}$	26	705-50-49	S-49
8	1	1 $\frac{1}{4}$	26	705-50-50	S-50

These cutters are often used in pairs for sizing nuts, bolt heads and for similar jobs, and are then called "Straddle Milling Cutters." They have cutting edges on both sides of the teeth as well as on the periphery.



These Side Milling Cutters are straddle milling the head of a special bolt held in a quick acting indexing fixture, permitting three passes of the cutter to complete a hexagonal head.

List of Keyways, page 32.

Packed one in a box.

For Prices, See Separate Section

Half Side Milling Cutters

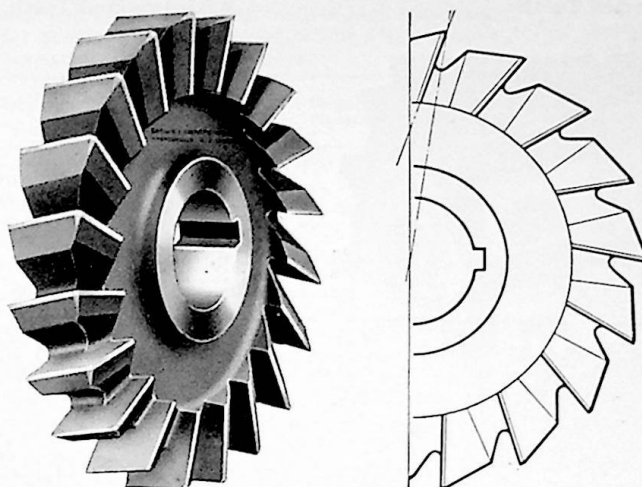


Illustration shows Left-Hand Cutter

Diameter, Inches	Width of Face, Inches	Hole, Inches	No. of Teeth	Hand	Order by Number	Old Catalog Number
4	3/4	1 1/4	16	Right	705-51-354	S-354
4	3/4	1 1/4	16	Left	705-52-354	S-354
5	3/4	1 1/4	18	Right	705-51-358	S-358
5	3/4	1 1/4	18	Left	705-52-358	S-358
6	3/4	1 1/4	20	Right	705-51-362	S-362
6	3/4	1 1/4	20	Left	705-52-362	S-362
6	1	1 1/2	20	Right	705-51-366	S-366
6	1	1 1/2	20	Left	705-52-366	S-366
7	3/4	1 1/2	24	Right	705-51-370	S-370
7	3/4	1 1/2	24	Left	705-52-370	S-370
7	1	1 1/2	24	Right	705-51-374	S-374
7	1	1 1/2	24	Left	705-52-374	S-374
8	3/4	1 1/2	26	Right	705-51-375	S-375
8	3/4	1 1/2	26	Left	705-52-375	S-375
8	1	1 1/2	26	Right	705-51-376	S-376
8	1	1 1/2	26	Left	705-52-376	S-376

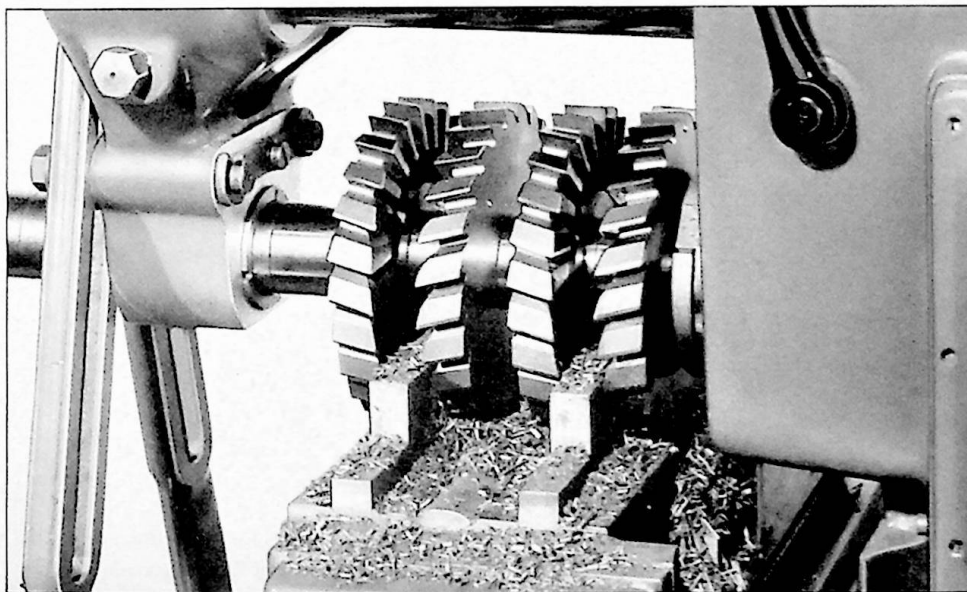
These side milling cutters can be used for all side cuts where one side of the cutter only is cutting such as in straddle milling or in cutting slots where complete bottom finish is not required.

Note the spiral on the top and undercut on the side, which gives the teeth an improved cutting action.

List of Keyways, page 32.

Packed one in a box.

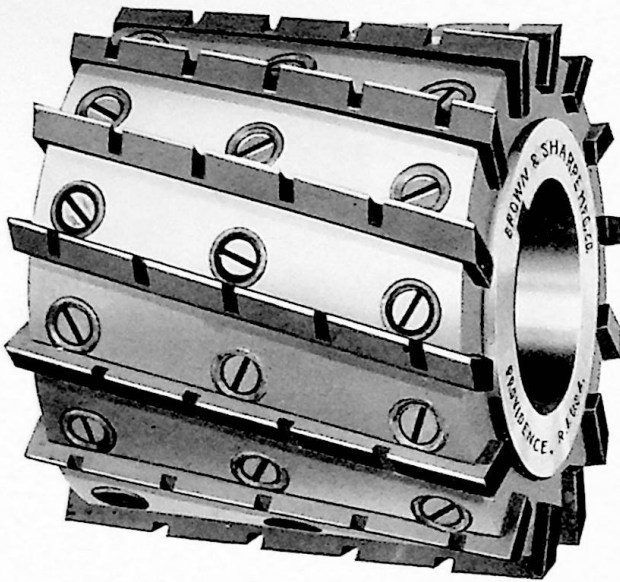
Two pairs of Half Side Milling Cutters shown in this illustration are rapidly milling to accurate size and location the guides on the underneath side of a slide. The cutters are admirably suited, because of the spiral undercut teeth, for efficient straddle milling.



For Prices, See Separate Section

Plain Milling Cutters

With Inserted Teeth



The high speed steel teeth of these Plain Milling Cutters are inserted in the periphery of a heat-treated alloy steel body. The bushings, screws and teeth are interchangeable, allowing the teeth to be adjusted or removed easily.

Plain Milling Cutters with inserted teeth are made to order.

Cutters with Stellite teeth can be furnished.

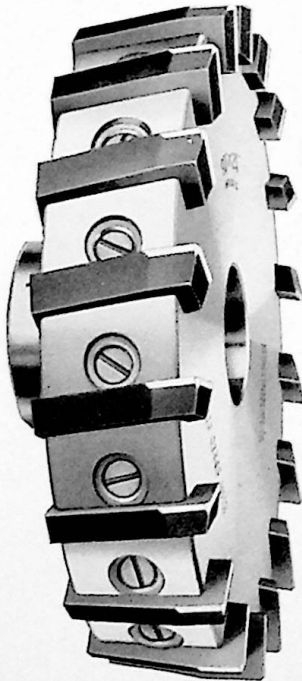
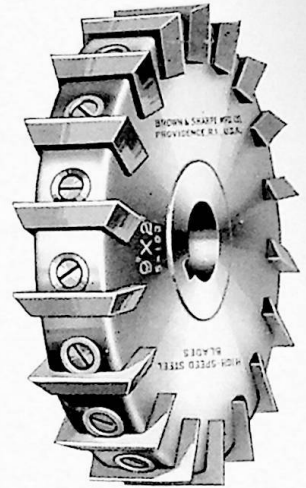


Illustration shows
Left-Hand Cutter

For Prices, See Separate Section

Side Milling Cutters

With Inserted Teeth



The high speed steel teeth of these Side Milling Cutters are inserted in the periphery of a heat-treated alloy steel body. The bushings, screws and teeth are interchangeable, allowing the teeth to be adjusted or removed easily.

Diameter of Cutter, Inches	Width of Face, Inches	Hole, Inches	No. of Teeth	Order by Number	Old Catalog Number
6	2	1 1/4	12	705-90-100	S-100
7	2	1 1/4	14	705-90-101	S-101
7	2	1 3/4	14	705-90-101-1	S-101A
8	2	1 1/2	16	705-90-102	S-102
8	2	2	16	705-90-102-1	S-102A
9	2	1 1/2	18	705-90-103	S-103
10	2	1 1/2	20	705-90-104	S-104

Cutters with Stellite teeth or with teeth having Tungsten Carbide tips can be furnished. Modification of body design with change of number of teeth and rake angle may be required for cutters having teeth with Tungsten Carbide tips according to the nature of the work and the material to be milled.

List of Keyways, page 32.

Face Milling Cutters

With Inserted Teeth

These cutters are adapted especially to all classes of face milling.

The body is heat-treated alloy steel provided with a taper hole and keyway and is held firmly in place on the arbor by a screw.

Cutters are furnished with teeth of high speed steel. The teeth are held in place by taper bushings and screws and can be adjusted easily or removed. The bushings, screws and teeth are interchangeable.

Cutters with Stellite teeth or with teeth having Tungsten Carbide tips can be furnished. Modification of body design with change of number of teeth and rake angle may be required for cutters having teeth with Tungsten Carbide tips according to the nature of the work and the material to be milled.

Diameter of Cutter, Inches	Width of Face, Inches	No. of Taper Hole	No. of Teeth	Hand	Order by Number	Old Catalog Number
5 1/2	2 1/4	10	10	Right	705-91-1	A-1
5 1/2	2 1/4	10	10	Left	705-92-1	A-1
5 1/2	2 1/4	12	10	Right	705-91-2	A-2
5 1/2	2 1/4	12	10	Left	705-92-2	A-2
6 1/2	2 1/4	10	12	Right	705-91-3	A-3
6 1/2	2 1/4	10	12	Left	705-92-3	A-3
6 1/2	2 1/4	12	12	Right	705-91-4	A-4
6 1/2	2 1/4	12	12	Left	705-92-4	A-4
7 1/2	2 1/4	12	14	Right	705-91-6	A-6
7 1/2	2 1/4	12	14	Left	705-92-6	A-6
8 1/2	2 1/4	12	16	Right	705-91-7	A-7
8 1/2	2 1/4	12	16	Left	705-92-7	A-7
9 1/2	2 1/4	12	18	Right	705-91-8	A-8
9 1/2	2 1/4	12	18	Left	705-92-8	A-8

Furnished with corners of teeth chamfered unless otherwise ordered.

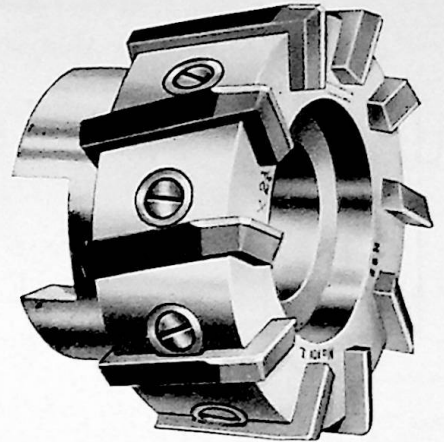
List of arbors, page 50.

Each of the above packed one in a wooden box.

**Face Milling Cutters
With Inserted Teeth**

The body is heat-treated alloy steel and is furnished with teeth of high speed steel. The teeth are held in place by taper bushings and screws and can be adjusted or removed easily. The bushings, screws and teeth are interchangeable.

Diameter of Cutter, Inches	Width of Face, Inches	Machines and Arbors where used	No. of Taper Hole	No. of Teeth	Hand	Order by Number	Old Catalog Number
5½	2¼	Machines with Standardized Spindle End and with Taper-Nose Spindle using Arbors on page 50.	14	10	Left	705-92-101	A-101
6½	2¼		14	12	Left	705-92-103	A-103
7½	2¼		14	14	Left	705-92-106	A-106



Corners of teeth are chamfered unless otherwise ordered. Cutters with Stellite teeth or with teeth having Tungsten Carbide tips can be furnished. Modification of body design with change of number of teeth and rake angle may be required for cutters having teeth with Tungsten Carbide tips according to the nature of the work and the material to be milled.

**Face Milling Cutters
With Inserted Teeth**

For Brown & Sharpe Milling Machines having Taper-Nose Spindle

These cutters are fitted directly on nose of spindle without the use of an arbor. Body of the cutter is heat-treated alloy steel; teeth are high speed steel. The teeth are held in place by taper bushings and screws, and can be adjusted or removed easily. The bushings, screws and teeth are interchangeable.



Diameter of Cutter, Inches	Width of Face, Inches	Machines where used	No. of Teeth	Hand	Order by Number	Old Catalog Number
6	2¼	Machines and Vert. Milling Atts. with 3" diameter Taper-Nose Spindle	12	Left	705-92-150	A-150
7	3		14	Left	705-92-151	A-151
8	3		16	Left	705-92-152	A-152
9½	3½	Machines and Vert. Milling Atts. with 5¼" diam. Taper-Nose Spindle	18	Left	705-92-156	A-156
10½	3½		20	Left	705-92-157	A-157
12	3½		24	Left	705-92-158	A-158
15	3½		30	Left	705-92-159	A-159

Corners of teeth are chamfered unless otherwise ordered. Cutters with Stellite teeth or with teeth having Tungsten Carbide tips can be furnished. Modification of body design with change of number of teeth and rake angle may be required for cutters having teeth with Tungsten Carbide tips according to the nature of the work and the material to be milled.

**Face Milling Cutters
With Inserted Teeth**

For Milling Machines having No. 50 Taper Standardized Spindle End

The body of cutter is of heat-treated alloy steel; the teeth are of high speed steel. The teeth are held in place by taper bushings and screws, and can be adjusted or removed easily. The bushings, screws and teeth are interchangeable. Cutter is centered on outside diameter of spindle and is secured in place by four holding screws. It is driven positively by keys on end of spindle. Holding screws and wrenches for attaching cutters can be furnished as extras. If required, specify when ordering.

Diameter of Cutter, Inches	Width of Face, Inches	Diam of Ground Recess, Inches	No. of Teeth	Hand	Order by Number	Old Catalog Number
*8	3	5.062	16	Right	705-91-252	A-252
*8	3	5.062	16	Left	705-92-252	A-252
9	3	5.062	18	Right	705-91-256	A-256
9	3	5.062	18	Left	705-92-256	A-256
10	3	5.062	20	Right	705-91-257	A-257
10	3	5.062	20	Left	705-92-257	A-257
12	3	5.062	24	Right	705-91-258	A-258
12	3	5.062	24	Left	705-92-258	A-258
15	3	5.062	30	Right	705-91-259	A-259
15	3	5.062	30	Left	705-92-259	A-259

Corners of teeth are chamfered unless otherwise ordered. *Differs from description in that teeth are held in place in body by pins. Cutters with Stellite teeth or with teeth having Tungsten Carbide tips can be furnished. Modification of body design with change of number of teeth and rake angle may be required for cutters having teeth with Tungsten Carbide tips according to the nature of the work and the material to be milled.

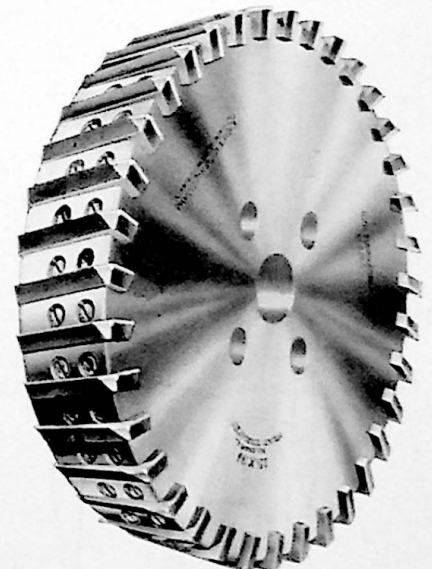


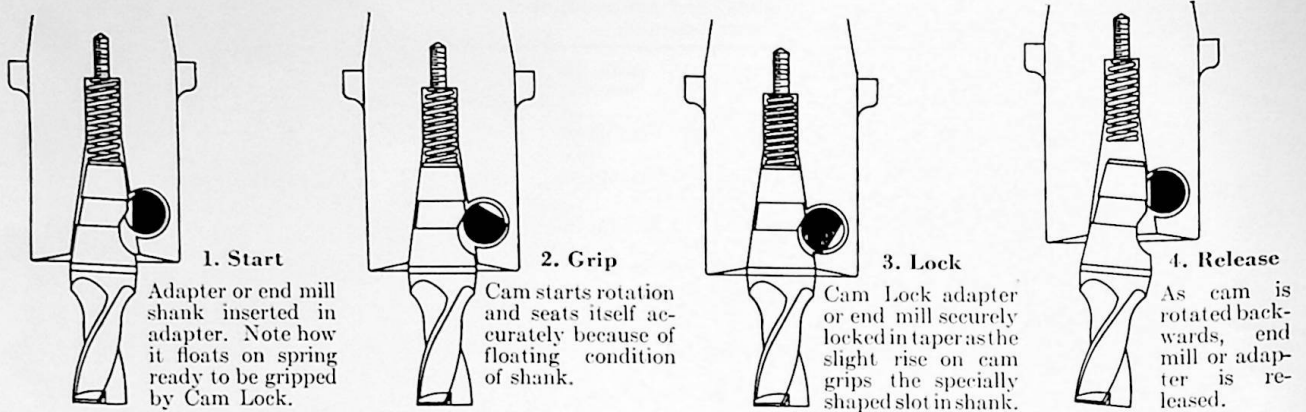
Illustration shows Left-Hand Cutter

Each of the above packed one in a wooden box.

For Prices, See Separate Section

Cam Lock—The Modern End Mill Drive

4 quick steps that save many minutes in changing End Mills or Adapters



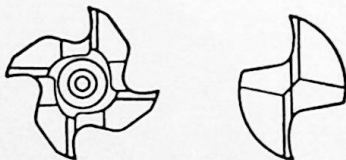
BROWN & SHARPE Cam Lock is a patented device incorporated in cutter adapters and some milling machine attachments and designed to give positive locking, positive drive and quick release to end mills and to other adapters.

The positive lock prevents a mill or adapter from being pulled out, either by the cut or vibration. The positive drive prevents slipping. A simple turn of a wrench locks or releases the mill.

Brown & Sharpe End Mills

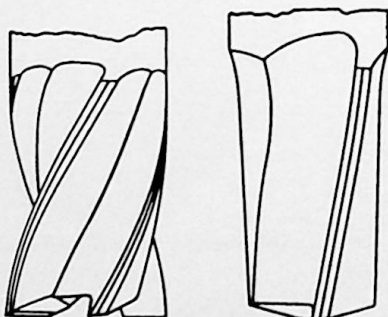
Cut Faster, More Freely and Require Less Power

The design features of Brown & Sharpe End Mills are the result of our extensive experience not only with the manufacture but with the use of countless end mills in our own plant. The angle of rake reduces power consumption and increases the number of pieces per sharpening. The helix angle provides smooth cutting action and the number of teeth increases the cutting efficiency and makes possible strong teeth with ample chip space between them. The double angle land permits the correct clearance on these strong teeth without having the heel of the land rub on the work. Materials are selected carefully for their appropriateness for the work and the heat treatment is performed by craftsmen under carefully controlled conditions. The use of Brown & Sharpe End Mills results in greater production, greater economy and longer end mill life.



Hollow Faces and Angle of Rake

The hollow faces and rake are produced by a generating process which provides a smooth surface and cutting edge.



Correct Number of Teeth

Tooth design increases cutting efficiency and enables teeth to be made much stronger with greater chip space.

Strong Teeth

The use of a double angle land gives the desired cutting clearance without danger of the heel of the land rubbing on the work and makes strong teeth practical.

Correct Helix Angle

The helix angles have been selected carefully after exhaustive tests and actual operations. They contribute to the smooth cutting action and high productivity of the end mills.

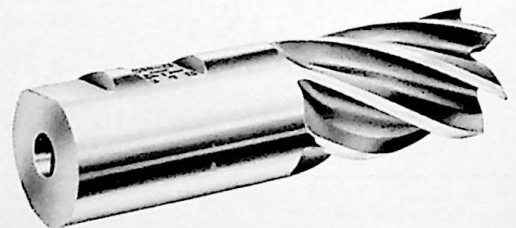
Fast Spiral Angle for Fast Cutting

The fast spiral angle used for the teeth of many of the end mills has been selected after considerable experimentation and investigation and provides extremely fast cutting action for most end milling requirements.

Small Helix Angle for Accuracy

In addition to the fast spiral angle, Brown & Sharpe Two-Flute End Mills are available also with a small helix angle for milling slots where extreme accuracy is essential.

Single-End End Mills with Shanks $\frac{7}{8}$ " in Diameter and Larger have Two Holding Flats



An important feature of Brown & Sharpe Single-End End Mills with shanks $\frac{7}{8}$ " in diameter and larger, consists of two holding flats for these mills as shown above. These two flats provide firm holding and strong driving in larger sizes.

Spiral End Mills

With Straight Shank



Illustration shows Right-Hand Mill

Shank is same diameter as end mill.

End teeth of end mills smaller than 1/4" in diameter shown in line illustration at left, do not have central recess of larger mills shown at right.



Spiral End Mills

With Milling Machine Standard Taper Shank

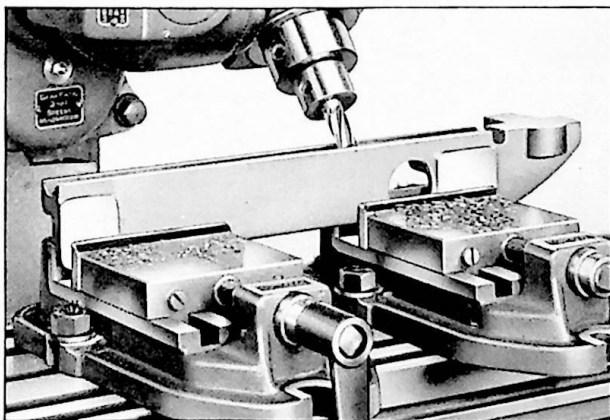


Illustration shows Right-Hand Mill

For use with Cutter Adapters with Cam Lock, page 18.

Diameter of End Mill, Inches	Length of Cut, Inches	Length Overall, Inches	No. of Teeth	Hand	Order by Number	Old Catalog Number
1/8	5/16	1 1/4	4	Right	705-131-650	E-650
1/8	5/16	1 1/4	4	Left	705-132-650	E-650
5/32	5/16	1 1/4	4	Right	705-131-651	E-651
5/32	5/16	1 1/4	4	Left	705-132-651	E-651
3/16	1/2	1 3/8	4	Right	705-131-652	E-652
3/16	1/2	1 3/8	4	Left	705-132-652	E-652
1/32	9/16	1 5/8	4	Right	705-131-653	E-653
1/32	9/16	1 5/8	4	Left	705-132-653	E-653
1/4	5/8	1 11/16	4	Right	705-131-654	E-654
1/4	5/8	1 11/16	4	Left	705-132-654	E-654
5/16	11/16	1 3/4	4	Right	705-131-656	E-656
5/16	11/16	1 3/4	4	Left	705-132-656	E-656
3/8	3/4	1 13/16	4	Right	705-131-658	E-658
3/8	3/4	1 13/16	4	Left	705-132-658	E-658
7/16	7/8	2 3/16	4	Right	705-131-660	E-660
7/16	7/8	2 3/16	4	Left	705-132-660	E-660
1/2	1 1/16	2 1/4	4	Right	705-131-661	E-661
1/2	1 1/16	2 1/4	4	Left	705-132-661	E-661
9/16	1	2 5/16	4	Right	705-131-662	E-662
9/16	1	2 5/16	4	Left	705-132-662	E-662
5/8	1 1/8	2 1/2	4	Right	705-131-663	E-663
5/8	1 1/8	2 1/2	4	Left	705-132-663	E-663
3/4	1 1/4	2 5/8	4	Right	705-131-665	E-665
3/4	1 1/4	2 5/8	4	Left	705-132-665	E-665

Sizes 1/8" to 5/16" dia. incl. packed one dozen in a box; all others one in a box.



End Mill with a Milling Machine Standard Taper Shank is milling the bevelled surface of a machine way. It is held in a Cam Lock Adapter and can be removed for sharpening or replaced by another mill in a matter of seconds—a time and cost saving advantage.

Diameter of End Mill, Inches	For use with Adapters having M.M. Standard Taper Hole No.	Length of Cut, Inches	Length Overall, Inches	No. of Teeth	Hand	Order by Number	Old Catalog Number
1/4	10	5/8	2	4	Right	705-131-1002	E-1002
1/4	10	5/8	2	4	Left	705-132-1002	E-1002
3/8	10	3/4	2 1/8	4	Right	705-131-1004	E-1004
3/8	10	3/4	2 1/8	4	Left	705-132-1004	E-1004
1/2	10	1 1/16	2 5/16	4	Right	705-131-1006	E-1006
1/2	10	1 1/16	2 5/16	4	Left	705-132-1006	E-1006
5/8	10	1 1/8	2 1/2	4	Right	705-131-1008	E-1008
5/8	10	1 1/8	2 1/2	4	Left	705-132-1008	E-1008
1 1/2	20	1 5/16	2 7/8	4	Right	705-131-2002	E-2002
1 1/2	20	1 5/16	2 7/8	4	Left	705-132-2002	E-2002
5/8	20	1 1/8	3 1/16	4	Right	705-131-2004	E-2004
5/8	20	1 1/8	3 1/16	4	Left	705-132-2004	E-2004
3/4	20	1 1/4	3 3/16	4	Right	705-131-2006	E-2006
3/4	20	1 1/4	3 3/16	4	Left	705-132-2006	E-2006
7/8	20	1 3/16	3 3/8	4	Right	705-131-2008	E-2008
7/8	20	1 3/16	3 3/8	4	Left	705-132-2008	E-2008
1	20	1 5/8	3 3/16	4	Right	705-131-2010	E-2010
1	20	1 5/8	3 3/16	4	Left	705-132-2010	E-2010
1 1/8	20	1 3/4	3 11/16	6	Right	705-131-2012	E-2012
1 1/8	20	1 3/4	3 11/16	6	Left	705-132-2012	E-2012
1 1/4	20	2	3 15/16	6	Right	705-131-2014	E-2014
1 1/4	20	2	3 15/16	6	Left	705-132-2014	E-2014
3/4	30	1 1/4	3 3/4	4	Right	705-131-3000	E-3000
3/4	30	1 1/4	3 3/4	4	Left	705-132-3000	E-3000
7/8	30	1 7/16	3 15/16	4	Right	705-131-3001	E-3001
7/8	30	1 7/16	3 15/16	4	Left	705-132-3001	E-3001
1	30	1 5/8	4 1/8	4	Right	705-131-3002	E-3002
1	30	1 5/8	4 1/8	4	Left	705-132-3002	E-3002
1 1/8	30	1 3/4	4 1/4	6	Right	705-131-3004	E-3004
1 1/8	30	1 3/4	4 1/4	6	Left	705-132-3004	E-3004
1 1/4	30	2	4 1/2	6	Right	705-131-3006	E-3006
1 1/4	30	2	4 1/2	6	Left	705-132-3006	E-3006
1 3/8	30	2 1/8	4 5/8	6	Right	705-131-3008	E-3008
1 3/8	30	2 1/8	4 5/8	6	Left	705-132-3008	E-3008
1 1/2	30	2 1/4	4 3/4	6	Right	705-131-3010	E-3010
1 1/2	30	2 1/4	4 3/4	6	Left	705-132-3010	E-3010
1 5/8	30	2 3/8	4 7/8	6	Right	705-131-3012	E-3012
1 5/8	30	2 3/8	4 7/8	6	Left	705-132-3012	E-3012
1 3/4	30	2 1/2	5	6	Right	705-131-3014	E-3014
1 3/4	30	2 1/2	5	6	Left	705-132-3014	E-3014

Packed one in a box.

For Prices, See Separate Section

Spiral End Mills

With Brown & Sharpe Taper Shank

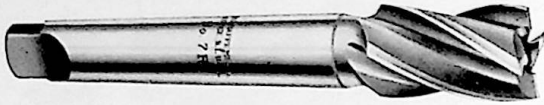


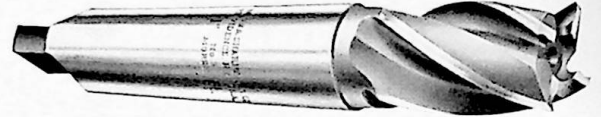
Illustration shows Right-Hand Mill

End Mills with No. 5 Taper Shanks have Plain Ends, not Tang End shown.



Spiral End Mills

With Morse Taper Shank



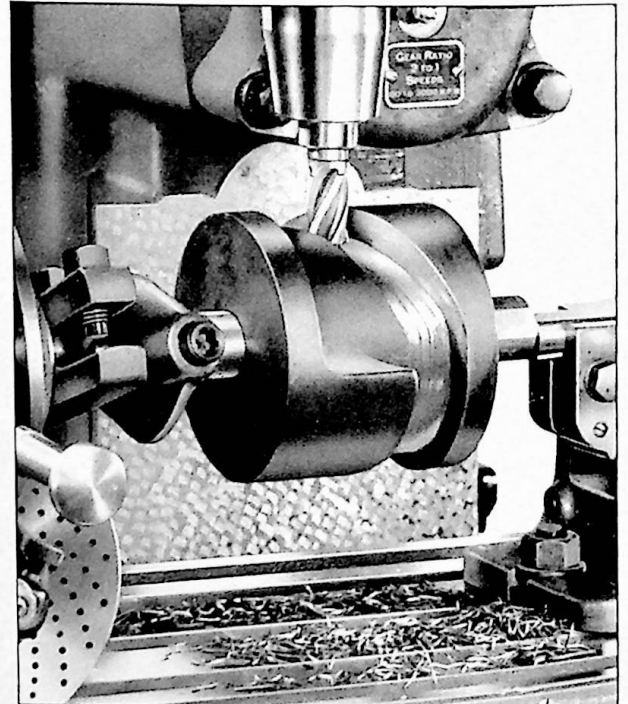
Diameter of End Mill, Inches	No. of Taper Shank	Length of Cut, Inches	Length Overall, Inches	No. of Teeth	Hand	Order by Number	Old Catalog Number
1/4	5	5/8	2 13/16	4	Right	705-131-101	E-101
1/4	5	5/8	2 13/16	4	Left	705-132-101	E-101
5/16	5	11/16	2 7/8	4	Right	705-131-103	E-103
5/16	5	11/16	2 7/8	4	Left	705-132-103	E-103
3/8	5	3/4	2 15/16	4	Right	705-131-105	E-105
3/8	5	3/4	2 15/16	4	Left	705-132-105	E-105
1/2	5	7/8	3 1/16	4	Right	705-131-107	E-107
1/2	5	7/8	3 1/16	4	Left	705-132-107	E-107
1/2	5	15/16	3 1/8	4	Right	705-131-108	E-108
1/2	5	15/16	3 1/8	4	Left	705-132-108	E-108
1/2	7	15/16	4 15/16	4	Right	705-131-109	E-109
1/2	7	15/16	4 15/16	4	Left	705-132-109	E-109
5/16	7	1	5	4	Right	705-131-111	E-111
5/16	7	1	5	4	Left	705-132-111	E-111
3/8	7	1 1/8	5 1/8	4	Right	705-131-113	E-113
3/8	7	1 1/8	5 1/8	4	Left	705-132-113	E-113
3/4	7	1 1/4	5 1/4	4	Right	705-131-116	E-116
3/4	7	1 1/4	5 1/4	4	Left	705-132-116	E-116
7/8	7	1 1/16	5 7/16	4	Right	705-131-120	E-120
7/8	7	1 1/16	5 7/16	4	Left	705-132-120	E-120
1	7	1 5/8	5 5/8	4	Right	705-131-124	E-124
1	7	1 5/8	5 5/8	4	Left	705-132-124	E-124
1 1/8	9	1 3/4	7	6	Right	705-131-129	E-129
1 1/8	9	1 3/4	7	6	Left	705-132-129	E-129
1 1/4	9	2	7 1/4	6	Right	705-131-133	E-133
1 1/4	9	2	7 1/4	6	Left	705-132-133	E-133
1 1/2	9	2 1/4	7 1/2	6	Right	705-131-137	E-137
1 1/2	9	2 1/4	7 1/2	6	Left	705-132-137	E-137
1 3/4	9	2 1/2	7 3/4	6	Right	705-131-139	E-139
1 3/4	9	2 1/2	7 3/4	6	Left	705-132-139	E-139
2	9	2 3/4	8	8	Right	705-131-141	E-141
2	9	2 3/4	8	8	Left	705-132-141	E-141

Packed one in a box.

Diameter of End Mill, Inches	No. of Taper Shank	Length of Cut, Inches	Length Overall, Inches	No. of Teeth	Hand	Order by Number	Old Catalog Number
1/4	1	5/8	3 1/2	4	Right	705-131-395	E-395
5/16	1	11/16	3 9/16	4	Right	705-131-396	E-396
3/8	1	3/4	3 3/8	4	Right	705-131-397	E-397
7/16	1	7/8	3 3/4	4	Right	705-131-398	E-398
1/2	1	15/16	3 13/16	4	Right	705-131-400	E-400
1/2	2	15/16	4 7/16	4	Right	705-131-401	E-401
5/8	2	1 1/8	4 3/8	4	Right	705-131-404	E-404
3/4	2	1 1/4	4 3/4	4	Right	705-131-406	E-406
3/4	3	1 1/4	5 9/16	4	Right	705-131-407	E-407
7/8	2	1 7/16	4 15/16	4	Right	705-131-410	E-410
7/8	3	1 1/16	5 3/4	4	Right	705-131-411	E-411
1	2	1 5/8	5 1/8	4	Right	705-131-414	E-414
1	3	1 5/8	5 15/16	4	Right	705-131-415	E-415
1 1/8	3	1 3/4	6 1/16	6	Right	705-131-418	E-418
1 1/4	3	2	6 5/16	6	Right	705-131-420	E-420

Left-Hand Mills made to order.

Packed one in a box.



The milling of this cam slot with a Spiral End Mill was performed efficiently and to a high degree of accuracy. No matter how unusual the job may be, there is a Brown & Sharpe End Mill of a style and size to meet the requirement.

For Prices, See Separate Section

Fast Spiral Single-End End Mills

With Straight Shank



Illustration shows Right-Hand Mill



End teeth of end mills smaller than 1/4" in diameter, shown in line illustration at left, do not have central recess of larger mills shown at right.



End Mills with shanks 7/8" in diameter and larger differ from illustration; these mills have two holding flats instead of the one shown.

Diameter of End Mill, Inches	Diameter of Shank, Inches	Length of Cut, Inches	Length Over-all, Inches	No. of Teeth	Hand	Order by Number	Old Catalog Number
1/8	3/8	3/8	2 5/16	4	Right	705-131-700	E-700
1/8	3/8	3/8	2 5/16	4	Left	705-132-700	E-700
3/16	3/8	1/2	2 3/8	4	Right	705-131-702	E-702
3/16	3/8	1/2	2 3/8	4	Left	705-132-702	E-702
1/4	3/8	5/8	2 7/16	4	Right	705-131-704	E-704
1/4	3/8	5/8	2 7/16	4	Left	705-132-704	E-704
5/16	3/8	3/4	2 1/2	4	Right	705-131-706	E-706
5/16	3/8	3/4	2 1/2	4	Left	705-132-706	E-706
3/8	3/8	3/4	2 1/2	4	Right	705-131-708	E-708
3/8	3/8	3/4	2 1/2	4	Left	705-132-708	E-708
7/16	3/8	1	2 11/16	4	Right	705-131-710	E-710
7/16	3/8	1	2 11/16	4	Left	705-132-710	E-710
1/2	3/8	1	2 11/16	4	Right	705-131-711	E-711
1/2	1/2	1 1/4	3 1/4	4	Right	705-131-712	E-712
1/2	1/2	1 1/4	3 1/4	4	Left	705-132-712	E-712
9/16	1/2	1 3/8	3 3/8	4	Right	705-131-713	E-713
5/8	1/2	1 3/8	3 3/8	4	Right	705-131-713-1	E-713A
5/8	5/8	1 5/8	3 3/4	4	Right	705-131-714	E-714
5/8	5/8	1 5/8	3 3/4	4	Left	705-132-714	E-714
11/16	1/2	1 5/8	3 5/8	4	Right	705-131-715	E-715
11/16	5/8	1 5/8	3 3/4	4	Right	705-131-715-1	E-715A
3/4	1/2	1 5/8	3 5/8	4	Right	705-131-715-2	E-715B
3/4	5/8	1 5/8	3 3/4	4	Right	705-131-716	E-716
3/4	5/8	1 5/8	3 3/4	4	Left	705-132-716	E-716
13/16	5/8	1 7/8	4	6	Right	705-131-718	E-718
7/8	5/8	1 7/8	4	6	Right	705-131-720	E-720
7/8	7/8	1 7/8	4 1/8	4	Right	705-131-722	E-722
1	5/8	1 7/8	4	6	Right	705-131-724	E-724
1	7/8	1 7/8	4 1/8	4	Right	705-131-726	E-726
1	1	2	4 1/2	4	Right	705-131-728	E-728
1 1/8	7/8	2	4 1/4	6	Right	705-131-730	E-730
1 1/8	1	2	4 1/2	6	Right	705-131-732	E-732
1 1/4	7/8	2	4 1/4	6	Right	705-131-734	E-734
1 1/4	1	2	4 1/2	6	Right	705-131-736	E-736
1 1/4	1 1/4	2	4 1/2	6	Right	705-131-738	E-738
1 3/8	1	2	4 1/2	6	Right	705-131-740	E-740
1 1/2	1	2	4 1/2	6	Right	705-131-742	E-742
1 1/2	1 1/4	2	4 1/2	6	Right	705-131-744	E-744
1 3/4	1 1/4	2	4 1/2	6	Right	705-131-746	E-746
2	1 1/4	2	4 1/2	8	Right	705-131-748	E-748

Sizes of Mills listed Right-Hand only are made Left-Hand to order.

Packed one in a box.

The two flats on Brown & Sharpe Single-End End Mills having shanks 7/8" in diameter and larger provide firm holding and strong driving for large end mills and heavy cuts.

Long, Fast Spiral Single-End End Mills

With Straight Shank



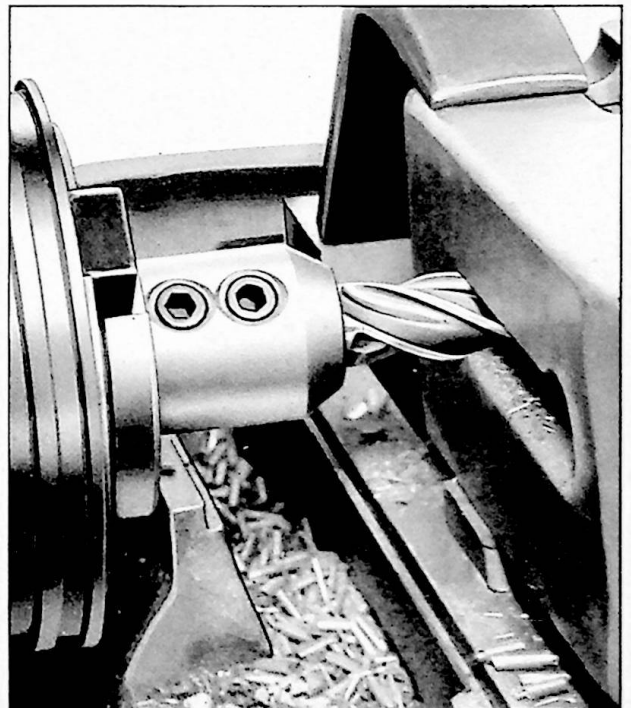
End Mills with shanks 7/8" in diameter and larger differ from illustration; these mills have two holding flats instead of the one shown.



Diameter of End Mill, Inches	Diameter of Shank, Inches	Length of Cut, Inches	Length Over-all, Inches	No. of Teeth	Hand	Order by Number	Old Catalog Number
1/4	3/8	1 1/4	3 1/16	4	Right	705-131-920	E-920
5/16	3/8	1 3/8	3 1/8	4	Right	705-131-922	E-922
3/8	3/8	1 1/2	3 3/4	4	Right	705-131-924	E-924
7/16	1/2	1 3/4	3 3/4	4	Right	705-131-926	E-926
1/2	1/2	2	4	4	Right	705-131-928	E-928
5/8	5/8	2 1/2	4 5/8	4	Right	705-131-930	E-930
3/4	3/4	3	5 1/4	4	Right	705-131-932	E-932
7/8	7/8	3 1/2	5 3/4	4	Right	705-131-934	E-934
1	1	4	6 1/2	4	Right	705-131-936	E-936
1 1/8	1	4	6 1/2	6	Right	705-131-938	E-938
1 1/4	1	4	6 1/2	6	Right	705-131-940	E-940
1 1/4	1 1/4	4	6 1/2	6	Right	705-131-942	E-942
1 1/2	1	4	6 1/2	6	Right	705-131-944	E-944
1 1/2	1 1/4	4	6 1/2	6	Right	705-131-946	E-946
1 3/4	1 1/4	4	6 1/2	6	Right	705-131-948	E-948
2	1 1/4	4	6 1/2	8	Right	705-131-950	E-950

Left-Hand Mills made to order.

Packed one in a box.



For Prices, See Separate Section

Extra Long, Fast Spiral Single-End End Mills

With Straight Shank



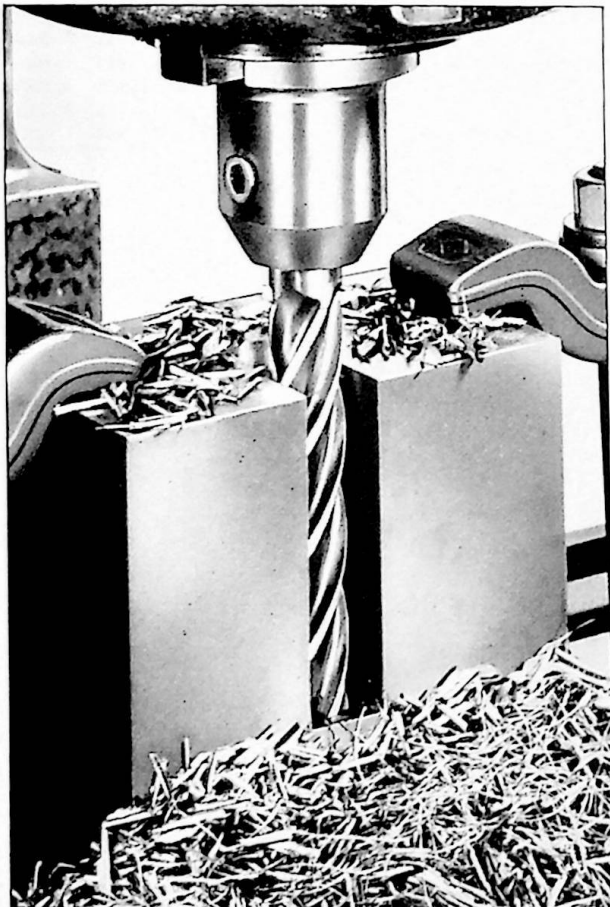
End Mills with shanks $\frac{7}{8}$ " in diameter and larger differ from illustration; these mills have two holding flats instead of the one shown.



Diameter of End Mill, Inches	Diameter of Shank, Inches	Length of Cut, Inches	Length Overall, Inches	No. of Teeth	Hand	Order by Number	Old Catalog Number
$\frac{1}{4}$	$\frac{3}{8}$	$1\frac{3}{4}$	$3\frac{3}{16}$	4	Right	705-131-975	E-975
$\frac{5}{16}$	$\frac{3}{8}$	2	$3\frac{3}{4}$	4	Right	705-131-976	E-976
$\frac{3}{8}$	$\frac{3}{8}$	$2\frac{1}{2}$	$4\frac{1}{4}$	4	Right	705-131-977	E-977
$\frac{1}{2}$	$\frac{1}{2}$	3	5	4	Right	705-131-978	E-978
$\frac{5}{8}$	$\frac{5}{8}$	4	$6\frac{1}{2}$	4	Right	705-131-979	E-979
$\frac{3}{4}$	$\frac{3}{4}$	4	$6\frac{1}{4}$	4	Right	705-131-980	E-980
$\frac{7}{8}$	$\frac{7}{8}$	5	$7\frac{1}{4}$	4	Right	705-131-981	E-981
1	1	6	$8\frac{1}{2}$	4	Right	705-131-982	E-982
$1\frac{1}{4}$	$1\frac{1}{4}$	6	$8\frac{1}{2}$	6	Right	705-131-983	E-983

Left-Hand Mills made to order.

Packed one in a box.



For Prices, See Separate Section

Fast Spiral Double-End End Mills

With Straight Shank



Illustration shows Right-Hand Mill

End teeth of end mills smaller than $\frac{1}{4}$ " in diameter shown in line illustration at left, do not have central recess of larger mills shown at right.



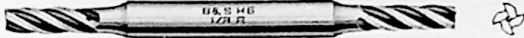
Diameter of End Mill, Inches	Diameter of Shank, Inches	Length of Cut, Inches	Length Overall, Inches	No. of Teeth	Hand	Order by Number	Old Catalog Number
$\frac{1}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$3\frac{1}{16}$	4	Right	705-131-750	E-750
$\frac{1}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$3\frac{1}{16}$	4	Left	705-132-750	E-750
$\frac{5}{32}$	$\frac{3}{8}$	$\frac{7}{16}$	$3\frac{1}{8}$	4	Right	705-131-751	E-751
$\frac{5}{32}$	$\frac{3}{8}$	$\frac{7}{16}$	$3\frac{1}{8}$	4	Left	705-132-751	E-751
$\frac{3}{16}$	$\frac{3}{8}$	$\frac{1}{2}$	$3\frac{1}{4}$	4	Right	705-131-752	E-752
$\frac{3}{16}$	$\frac{3}{8}$	$\frac{1}{2}$	$3\frac{1}{4}$	4	Left	705-132-752	E-752
$\frac{7}{32}$	$\frac{3}{8}$	$\frac{9}{16}$	$3\frac{1}{4}$	4	Right	705-131-753	E-753
$\frac{7}{32}$	$\frac{3}{8}$	$\frac{9}{16}$	$3\frac{1}{4}$	4	Left	705-132-753	E-753
$\frac{1}{4}$	$\frac{3}{8}$	$\frac{5}{8}$	$3\frac{3}{8}$	4	Right	705-131-754	E-754
$\frac{1}{4}$	$\frac{3}{8}$	$\frac{5}{8}$	$3\frac{3}{8}$	4	Left	705-132-754	E-754
$\frac{9}{32}$	$\frac{3}{8}$	$1\frac{1}{16}$	$3\frac{3}{8}$	4	Right	705-131-755	E-755
$\frac{9}{32}$	$\frac{3}{8}$	$\frac{3}{4}$	$3\frac{1}{2}$	4	Right	705-131-756	E-756
$\frac{3}{16}$	$\frac{3}{8}$	$\frac{3}{4}$	$3\frac{1}{2}$	4	Left	705-132-756	E-756
$\frac{11}{32}$	$\frac{3}{8}$	$\frac{3}{4}$	$3\frac{1}{2}$	4	Right	705-131-757	E-757
$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{4}$	$3\frac{1}{2}$	4	Right	705-131-758	E-758
$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{4}$	$3\frac{1}{2}$	4	Left	705-132-758	E-758
$\frac{13}{32}$	$\frac{1}{2}$	1	$4\frac{1}{8}$	4	Right	705-131-759	E-759
$\frac{7}{16}$	$\frac{1}{2}$	1	$4\frac{1}{8}$	4	Right	705-131-760	E-760
$\frac{7}{16}$	$\frac{1}{2}$	1	$4\frac{1}{8}$	4	Left	705-132-760	E-760
$\frac{15}{32}$	$\frac{1}{2}$	1	$4\frac{1}{8}$	4	Right	705-131-761	E-761
$\frac{1}{2}$	$\frac{1}{2}$	1	$4\frac{1}{8}$	4	Right	705-131-762	E-762
$\frac{1}{2}$	$\frac{1}{2}$	1	$4\frac{1}{8}$	4	Left	705-132-762	E-762
$\frac{9}{16}$	$\frac{5}{8}$	$1\frac{3}{8}$	5	4	Right	705-131-764	E-764
$\frac{9}{16}$	$\frac{5}{8}$	$1\frac{3}{8}$	5	4	Left	705-132-764	E-764
$\frac{5}{8}$	$\frac{5}{8}$	$1\frac{3}{8}$	5	4	Right	705-131-766	E-766
$\frac{5}{8}$	$\frac{5}{8}$	$1\frac{3}{8}$	5	4	Left	705-132-766	E-766
$\frac{11}{16}$	$\frac{3}{4}$	$1\frac{5}{8}$	$5\frac{5}{8}$	4	Right	705-131-767	E-767
$\frac{3}{4}$	$\frac{3}{4}$	$1\frac{5}{8}$	$5\frac{5}{8}$	4	Right	705-131-768	E-768
$\frac{3}{4}$	$\frac{3}{4}$	$1\frac{5}{8}$	$5\frac{5}{8}$	4	Left	705-132-768	E-768
$\frac{13}{16}$	$\frac{7}{8}$	$1\frac{7}{8}$	$6\frac{1}{8}$	4	Right	705-131-769	E-769
$\frac{7}{8}$	$\frac{7}{8}$	$1\frac{7}{8}$	$6\frac{1}{8}$	4	Right	705-131-770	E-770
1	1	$1\frac{7}{8}$	$6\frac{3}{8}$	4	Right	705-131-771	E-771

Sizes of Mills listed Right-Hand only are made Left-Hand to order.

Packed one in a box.

The capabilities of the Extra Long, Fast Spiral Single-End End Mills for end milling in unusually deep slots are demonstrated in this illustration. Where a deep slot is required in solid metal as shown, it must be roughed out in steps and finished with a light, skim cut only.

Fast Spiral Double-End End Mills
With 3/16" Straight Shank



Diameter of End Mill, Inches	Diameter of Shank, Inches	Length of Cut, Inches	Length Overall, Inches	No. of Teeth	Hand	Order by Number	Old Catalog Number
3/32	3/16	5/16	2 1/4	4	Right	705-131-780	E-780
*1/8	3/16	3/8	2 1/4	4	Right	705-131-782	E-782
*5/32	3/16	7/16	2 1/4	4	Right	705-131-784	E-784
*3/16	3/16	1/2	2 1/4	4	Right	705-131-786	E-786

*Left-Hand Mills made to order.
Packed one dozen in a box.

Two-Flute Small Helix Angle Spiral End Mills

With Milling Machine Standard Taper Shank

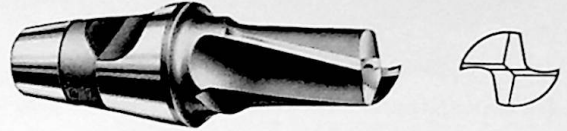
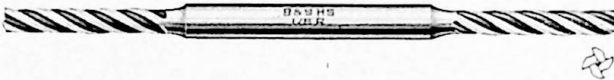


Illustration shows Right-Hand Mill.

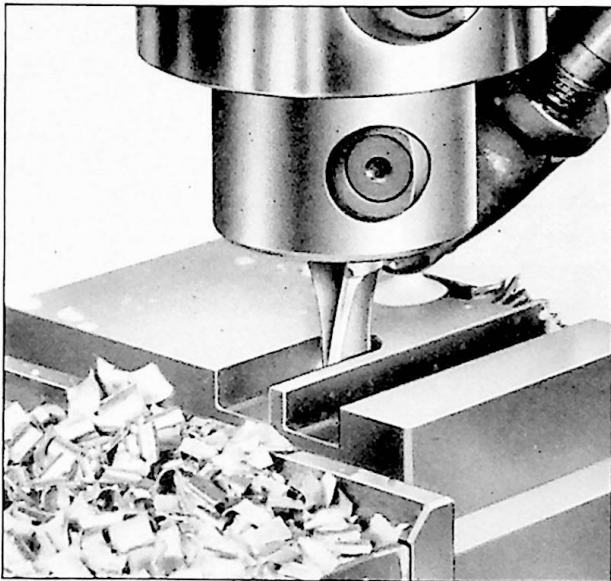
For use with Cutter Adapters with Cam Lock, page 18.
Suited for milling slots where extreme accuracy is essential.

Long, Fast Spiral Double-End End Mills
With 3/16" Straight Shank



Diameter of End Mill, Inches	Diameter of Shank, Inches	Length Below Shank, Inches	Length of Cut, Inches	Length Overall, Inches	No. of Teeth	Hand	Order by Number	Old Catalog Number
3/32	3/16	1/2	9/32	2 5/8	4	Right	705-131-900	E-900
*1/8	3/16	3/4	3/4	3 1/8	4	Right	705-131-902	E-902
*5/32	3/16	7/8	7/8	3 1/4	4	Right	705-131-904	E-904
*3/16	3/16	1	1	3 3/8	4	Right	705-131-906	E-906

*Left-Hand Mills made to order.
Packed one dozen in a box.



Two-Flute Small Helix Angle Spiral End Mills are well suited for milling slots requiring accuracy, as shown in this illustration. Their cutting efficiency while not quite equalling similar mills with the fast spiral, is entirely satisfactory as the chips indicate.

Diameter of End Mill, Inches	For use with Adapters having M.M. Standard Taper Hole, No.	Length of Cut, Inches	Length Overall, Inches	Hand	Order by Number	Old Catalog Number
1/4	10	3/8	1 3/4	Right	705-131-1050	E-1050
1/4	10	3/8	1 3/4	Left	705-132-1050	E-1050
5/16	10	15/32	1 7/8	Right	705-131-1051	E-1051
5/16	10	15/32	1 7/8	Left	705-132-1051	E-1051
3/8	10	9/16	1 15/16	Right	705-131-1052	E-1052
3/8	10	9/16	1 15/16	Left	705-132-1052	E-1052
7/16	10	21/32	2 1/32	Right	705-131-1053	E-1053
7/16	10	21/32	2 1/32	Left	705-132-1053	E-1053
1/2	10	3/4	2 1/8	Right	705-131-1054	E-1054
1/2	10	3/4	2 1/8	Left	705-132-1054	E-1054
9/16	10	27/32	2 7/32	Right	705-131-1055	E-1055
9/16	10	27/32	2 7/32	Left	705-132-1055	E-1055
5/8	10	13/16	2 5/16	Right	705-131-1056	E-1056
5/8	10	13/16	2 5/16	Left	705-132-1056	E-1056
1/2	20	3/4	2 1/16	Right	705-131-2050	E-2050
1/2	20	3/4	2 1/16	Left	705-132-2050	E-2050
9/16	20	27/32	2 25/32	Right	705-131-2051	E-2051
9/16	20	27/32	2 25/32	Left	705-132-2051	E-2051
5/8	20	13/16	2 7/8	Right	705-131-2052	E-2052
5/8	20	13/16	2 7/8	Left	705-132-2052	E-2052
11/16	20	11/32	2 31/32	Right	705-131-2053	E-2053
11/16	20	11/32	2 31/32	Left	705-132-2053	E-2053
3/4	20	1 1/8	3 1/16	Right	705-131-2054	E-2054
3/4	20	1 1/8	3 1/16	Left	705-132-2054	E-2054
13/16	20	17/32	3 3/32	Right	705-131-2055	E-2055
13/16	20	17/32	3 3/32	Left	705-132-2055	E-2055
7/8	20	13/16	3 1/4	Right	705-131-2056	E-2056
7/8	20	13/16	3 1/4	Left	705-132-2056	E-2056
1	20	1 1/2	3 7/16	Right	705-131-2058	E-2058
1	20	1 1/2	3 7/16	Left	705-132-2058	E-2058
1 1/8	20	1 11/16	3 5/8	Right	705-131-2060	E-2060
1 1/8	20	1 11/16	3 5/8	Left	705-132-2060	E-2060
1 1/4	20	1 7/8	3 13/16	Right	705-131-2062	E-2062
1 1/4	20	1 7/8	3 13/16	Left	705-132-2062	E-2062
3/4	30	1 1/8	3 5/8	Right	705-131-3048	E-3048
3/4	30	1 1/8	3 5/8	Left	705-132-3048	E-3048
7/8	30	1 3/16	3 13/16	Right	705-131-3049	E-3049
7/8	30	1 3/16	3 13/16	Left	705-132-3049	E-3049
1	30	1 1/2	4	Right	705-131-3050	E-3050
1	30	1 1/2	4	Left	705-132-3050	E-3050
1 1/4	30	1 7/8	4 3/8	Right	705-131-3054	E-3054
1 1/4	30	1 7/8	4 3/8	Left	705-132-3054	E-3054
1 1/2	30	2 1/4	4 3/4	Right	705-131-3058	E-3058
1 1/2	30	2 1/4	4 3/4	Left	705-132-3058	E-3058

Packed one in a box.

For Prices, See Separate Section

Two-Flute Fast Spiral End Mills
With Milling Machine Standard Taper Shank

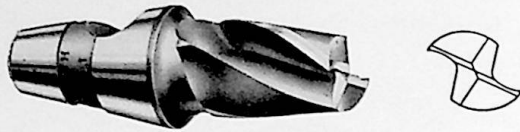


Illustration shows Right-Hand Mill

For use with Cutter Adapters with Cam Lock, see page 18.

Diameter of End Mill, Inches	For use with Adapters having M. M. Standard Taper Hole No.	Length of Cut, Inches	Length Overall, Inches	Hand	Order by Number	Old Catalog Number
1/4	10	3/8	1 3/4	Right	705-131-1075	E-1075
1/4	10	3/8	1 3/4	Left	705-132-1075	E-1075
5/16	10	15/32	1 7/8	Right	705-131-1076	E-1076
5/16	10	15/32	1 7/8	Left	705-132-1076	E-1076
3/8	10	9/16	1 15/16	Right	705-131-1077	E-1077
3/8	10	9/16	1 15/16	Left	705-132-1077	E-1077
7/16	10	21/32	2 1/32	Right	705-131-1078	E-1078
7/16	10	21/32	2 1/32	Left	705-132-1078	E-1078
1/2	10	3/4	2 1/8	Right	705-131-1079	E-1079
1/2	10	3/4	2 1/8	Left	705-132-1079	E-1079
5/8	10	15/16	2 5/16	Right	705-131-1081	E-1081
5/8	10	15/16	2 5/16	Left	705-132-1081	E-1081
1/2	20	3/4	2 11/16	Right	705-131-2075	E-2075
1/2	20	3/4	2 11/16	Left	705-132-2075	E-2075
5/8	20	15/16	2 7/8	Right	705-131-2077	E-2077
5/8	20	15/16	2 7/8	Left	705-132-2077	E-2077
3/4	20	1 1/8	3 1/16	Right	705-131-2079	E-2079
3/4	20	1 1/8	3 1/16	Left	705-132-2079	E-2079
7/8	20	1 5/16	3 1/4	Right	705-131-2081	E-2081
7/8	20	1 5/16	3 1/4	Left	705-132-2081	E-2081
1	20	1 1/2	3 7/16	Right	705-131-2083	E-2083
1	20	1 1/2	3 7/16	Left	705-132-2083	E-2083
1	30	1 1/2	4	Right	705-131-3075	E-3075
1	30	1 1/2	4	Left	705-132-3075	E-3075
1 1/4	30	1 7/8	4 3/8	Right	705-131-3077	E-3077
1 1/4	30	1 7/8	4 3/8	Left	705-132-3077	E-3077
1 1/2	30	2 1/4	4 3/4	Right	705-131-3079	E-3079
1 1/2	30	2 1/4	4 3/4	Left	705-132-3079	E-3079

Two-Flute Small Helix Angle Spiral End Mills

With Brown & Sharpe Taper Shank

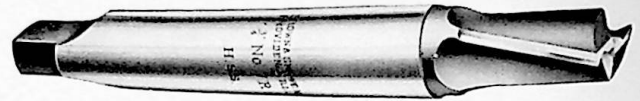


Illustration shows Right-Hand Mill

Small Helix Angle is especially suited for milling slots where extreme accuracy is essential.

End Mills with No. 5 Taper Shanks have Plain Ends, not Tang End shown.



Diameter of End Mill, Inches	No. of Taper Shank	Length of Cut, Inches	Length Overall, Inches	Hand	Order by Number	Old Catalog Number
1/4	5	3/8	2 9/16	Right	705-131-598	E-598
1/4	5	3/8	2 9/16	Left	705-132-598	E-598
5/16	5	15/32	2 21/32	Right	705-131-599	E-599
5/16	5	15/32	2 21/32	Left	705-132-599	E-599
3/8	7	3/8	4 3/8	Right	705-131-600	E-600
3/8	7	3/8	4 3/8	Left	705-132-600	E-600
7/16	7	15/32	4 15/32	Right	705-131-601	E-601
7/16	7	15/32	4 15/32	Left	705-132-601	E-601
1/2	7	3/4	4 3/4	Right	705-131-602	E-602
1/2	7	3/4	4 3/4	Left	705-132-602	E-602
5/8	7	7/16	4 21/32	Right	705-131-603	E-603
5/8	7	7/16	4 21/32	Left	705-132-603	E-603
3/4	7	1/2	4 3/4	Right	705-131-604	E-604
3/4	7	1/2	4 3/4	Left	705-132-604	E-604
7/8	7	5/8	4 15/16	Right	705-131-606	E-606
7/8	7	5/8	4 15/16	Left	705-132-606	E-606
1	7	3/4	5 1/8	Right	705-131-608	E-608
1	7	3/4	5 1/8	Left	705-132-608	E-608
1 1/8	7	15/16	5 5/16	Right	705-131-612	E-612
1 1/8	7	15/16	5 5/16	Left	705-132-612	E-612
1 1/4	9	1 1/2	6 3/4	Right	705-131-615	E-615
1 1/4	9	1 1/2	6 3/4	Left	705-132-615	E-615
1 1/2	9	1 7/8	7 1/8	Right	705-131-619	E-619
1 1/2	9	1 7/8	7 1/8	Left	705-132-619	E-619
1 3/4	9	2 1/4	7 1/2	Right	705-131-623	E-623
1 3/4	9	2 1/4	7 1/2	Left	705-132-623	E-623

Each of the above packed one in a box.



The accumulation of the chips shown in this illustration, their size and their uniform appearance, show the free cutting action of this Two-Flute Fast Spiral End Mill producing at a high rate the slots in the top plate of a permanent magnet chuck.

For Prices, See Separate Section

Two-Flute Fast Spiral End Mills

With Straight Shank



Illustration shows Right-Hand Mill

Shank is same diameter as end mill.

Two-Flute Fast Spiral Single-End End Mills

With Straight Shank



Illustration shows Right-Hand Mill

End Mills with shanks $\frac{7}{8}$ " in diameter and larger differ from illustration; these mills have two holding flats instead of the one shown.

Diameter of End Mill, Inches	Length of Cut, Inches	Length Overall, Inches	Hand	Order by Number	Old Catalog Number
$\frac{1}{4}$	$\frac{3}{8}$	$1\frac{1}{16}$	Right	705-131-675	E-675
$\frac{1}{4}$	$\frac{3}{8}$	$1\frac{1}{16}$	Left	705-132-675	E-675
$\frac{5}{16}$	$\frac{15}{32}$	$1\frac{1}{16}$	Right	705-131-676	E-676
$\frac{5}{16}$	$\frac{15}{32}$	$1\frac{1}{16}$	Left	705-132-676	E-676
$\frac{3}{8}$	$\frac{9}{16}$	$1\frac{5}{8}$	Right	705-131-677	E-677
$\frac{3}{8}$	$\frac{9}{16}$	$1\frac{5}{8}$	Left	705-132-677	E-677
$\frac{7}{16}$	$\frac{21}{32}$	2	Right	705-131-678	E-678
$\frac{7}{16}$	$\frac{21}{32}$	2	Left	705-132-678	E-678
$\frac{1}{2}$	$\frac{3}{4}$	$2\frac{1}{16}$	Right	705-131-679	E-679
$\frac{1}{2}$	$\frac{3}{4}$	$2\frac{1}{16}$	Left	705-132-679	E-679
$\frac{5}{8}$	$\frac{15}{16}$	$2\frac{5}{16}$	Right	705-131-681	E-681
$\frac{5}{8}$	$\frac{15}{16}$	$2\frac{5}{16}$	Left	705-132-681	E-681
$\frac{3}{4}$	$1\frac{1}{8}$	$2\frac{1}{2}$	Right	705-131-683	E-683
$\frac{3}{4}$	$1\frac{1}{8}$	$2\frac{1}{2}$	Left	705-132-683	E-683

Sizes $\frac{1}{4}$ " and $\frac{5}{16}$ " packed one dozen in a box; all others one in a box.

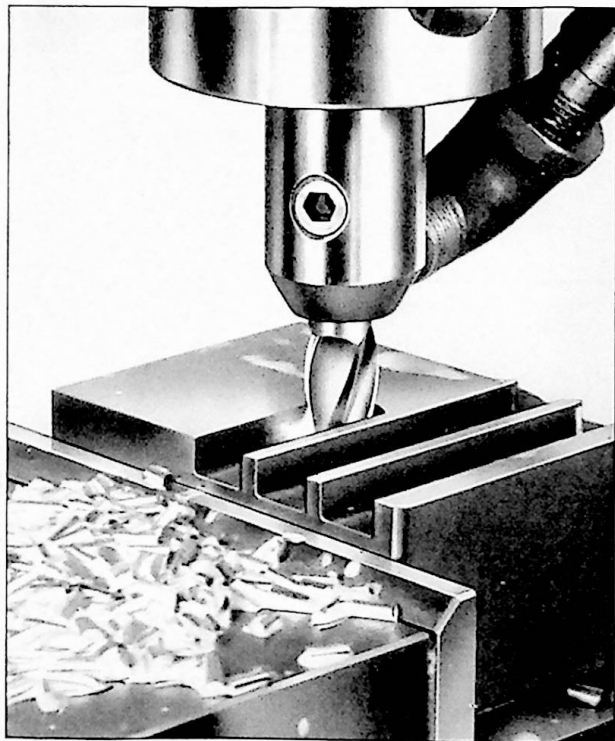
Diameter of End Mill, Inches	Diameter of Shank, Inches	Length of Cut, Inches	Length Overall, Inches	Hand	Order by Number	Old Catalog Number
$\frac{1}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$2\frac{5}{16}$	Right	705-131-800	E-800
$\frac{1}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$2\frac{5}{16}$	Left	705-132-800	E-800
$\frac{3}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$2\frac{5}{16}$	Right	705-131-802	E-802
$\frac{3}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$2\frac{5}{16}$	Left	705-132-802	E-802
$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$2\frac{5}{16}$	Right	705-131-804	E-804
$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$2\frac{5}{16}$	Left	705-132-804	E-804
$\frac{5}{16}$	$\frac{3}{8}$	$\frac{9}{16}$	$2\frac{5}{16}$	Right	705-131-806	E-806
$\frac{5}{16}$	$\frac{3}{8}$	$\frac{9}{16}$	$2\frac{5}{16}$	Left	705-132-806	E-806
$\frac{3}{8}$	$\frac{3}{8}$	$\frac{9}{16}$	$2\frac{5}{16}$	Right	705-131-808	E-808
$\frac{3}{8}$	$\frac{3}{8}$	$\frac{9}{16}$	$2\frac{5}{16}$	Left	705-132-808	E-808
$\frac{7}{16}$	$\frac{3}{8}$	$\frac{13}{16}$	$2\frac{1}{2}$	Right	705-131-810	E-810
$\frac{7}{16}$	$\frac{3}{8}$	$\frac{13}{16}$	$2\frac{1}{2}$	Left	705-132-810	E-810
$\frac{1}{2}$	$\frac{3}{8}$	$\frac{13}{16}$	$2\frac{1}{2}$	Right	705-131-811	E-811
$\frac{1}{2}$	$\frac{1}{2}$	1	3	Right	705-131-812	E-812
$\frac{1}{2}$	$\frac{1}{2}$	1	3	Left	705-132-812	E-812
$\frac{9}{16}$	$\frac{1}{2}$	$1\frac{1}{8}$	$3\frac{1}{8}$	Right	705-131-813	E-813
$\frac{5}{8}$	$\frac{1}{2}$	$1\frac{1}{8}$	$3\frac{1}{8}$	Right	705-131-814	E-814
$\frac{5}{8}$	$\frac{5}{8}$	$1\frac{5}{16}$	$3\frac{3}{16}$	Right	705-131-816	E-816
$\frac{5}{8}$	$\frac{5}{8}$	$1\frac{5}{16}$	$3\frac{3}{16}$	Left	705-132-816	E-816
$\frac{11}{16}$	$\frac{1}{2}$	$1\frac{5}{16}$	$3\frac{3}{16}$	Right	705-131-817	E-817
$\frac{11}{16}$	$\frac{5}{8}$	$1\frac{5}{16}$	$3\frac{3}{16}$	Right	705-131-817-1	E-817A
$\frac{3}{4}$	$\frac{1}{2}$	$1\frac{5}{16}$	$3\frac{3}{16}$	Right	705-131-817-2	E-817B
$\frac{3}{4}$	$\frac{5}{8}$	$1\frac{5}{16}$	$3\frac{3}{16}$	Right	705-131-818	E-818
$\frac{3}{4}$	$\frac{5}{8}$	$1\frac{5}{16}$	$3\frac{3}{16}$	Left	705-132-818	E-818
$\frac{13}{16}$	$\frac{5}{8}$	$1\frac{1}{2}$	$3\frac{5}{8}$	Right	705-131-820	E-820
$\frac{7}{8}$	$\frac{5}{8}$	$1\frac{1}{2}$	$3\frac{5}{8}$	Right	705-131-822	E-822
$\frac{7}{8}$	$\frac{7}{8}$	$1\frac{1}{2}$	$3\frac{3}{4}$	Right	705-131-824	E-824
1	$\frac{5}{8}$	$1\frac{1}{2}$	$3\frac{5}{8}$	Right	705-131-826	E-826
1	$\frac{7}{8}$	$1\frac{1}{2}$	$3\frac{3}{4}$	Right	705-131-828	E-828
1	1	$1\frac{5}{8}$	$4\frac{1}{8}$	Right	705-131-830	E-830
$1\frac{1}{8}$	1	$1\frac{5}{8}$	$4\frac{1}{8}$	Right	705-131-832	E-832
$1\frac{1}{4}$	$\frac{7}{8}$	$1\frac{5}{8}$	$3\frac{7}{8}$	Right	705-131-834	E-834
$1\frac{1}{4}$	1	$1\frac{5}{8}$	$4\frac{1}{8}$	Right	705-131-836	E-836
$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{5}{8}$	$4\frac{1}{8}$	Right	705-131-838	E-838
$1\frac{3}{8}$	1	$1\frac{5}{8}$	$4\frac{1}{8}$	Right	705-131-840	E-840
$1\frac{1}{2}$	1	$1\frac{5}{8}$	$4\frac{1}{8}$	Right	705-131-842	E-842
$1\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{5}{8}$	$4\frac{1}{8}$	Right	705-131-844	E-844
$1\frac{3}{4}$	$1\frac{1}{4}$	$1\frac{5}{8}$	$4\frac{1}{8}$	Right	705-131-846	E-846
2	$1\frac{1}{4}$	$1\frac{5}{8}$	$4\frac{1}{8}$	Right	705-131-848	E-848

Sizes of Mills listed Right-Hand only are made Left-Hand to order.

Packed one in a box.

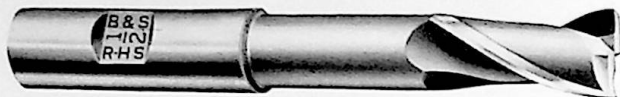
This Two-Flute Fast Spiral Single-End End Mill with straight shank mills slots rapidly with minimum power requirements. The steep spiral of the teeth is conducive to a free-cutting action wherever rapid cuts are required.

For Prices, See Separate Section



Long, Two-Flute Fast Spiral Single-End End Mills

With Straight Shank



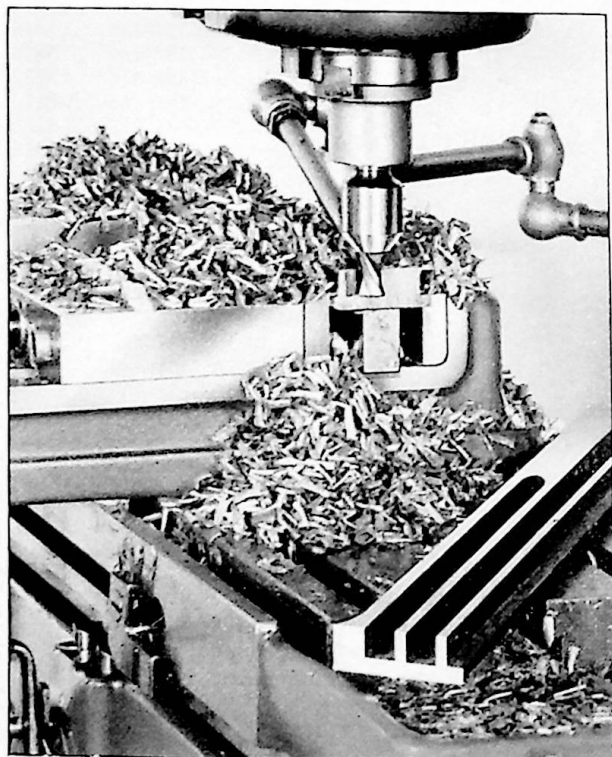
End Mills with shanks $\frac{7}{8}$ " in diameter and larger differ from illustration; these mills have two holding flats instead of the one shown.



Diameter of End Mill, Inches	Diameter of Shank, Inches	Length Below Shank, Inches	Length of Cut, Inches	Length Overall, Inches	Hand	Order by Number	Old Catalog Number
$\frac{1}{4}$	$\frac{3}{8}$	$1\frac{1}{2}$	$\frac{5}{8}$	$3\frac{1}{16}$	Right	705-131-960	E-960
$\frac{5}{16}$	$\frac{3}{8}$	$1\frac{3}{4}$	$\frac{3}{4}$	$3\frac{5}{16}$	Right	705-131-962	E-962
$\frac{3}{8}$	$\frac{3}{8}$	$1\frac{3}{4}$	$\frac{3}{4}$	$3\frac{3}{16}$	Right	705-131-964	E-964
$\frac{1}{2}$	$\frac{1}{2}$	$2\frac{1}{4}$	1	4	Right	705-131-966	E-966
$\frac{5}{8}$	$\frac{5}{8}$	$2\frac{3}{4}$	$1\frac{3}{8}$	$4\frac{5}{8}$	Right	705-131-968	E-968
$\frac{3}{4}$	$\frac{3}{4}$	$3\frac{3}{8}$	$1\frac{5}{8}$	$5\frac{3}{8}$	Right	705-131-970	E-970
1	1	5	$2\frac{1}{2}$	$7\frac{1}{4}$	Right	705-131-972	E-972

Left-Hand Mills made to order.

Packed one in a box.



For Prices, See Separate Section

Two-Flute Fast Spiral Double-End End Mills

With Straight Shank



Illustration shows Right-Hand Mill



Diameter of End Mill, Inches	Diameter of Shank, Inches	Length of Cut, Inches	Length Overall, Inches	Hand	Order by Number	Old Catalog Number
$\frac{1}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$3\frac{1}{16}$	Right	705-131-850	E-850
$\frac{1}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$3\frac{1}{16}$	Left	705-132-850	E-850
$\frac{5}{32}$	$\frac{3}{8}$	$\frac{7}{16}$	$3\frac{1}{8}$	Right	705-131-851	E-851
$\frac{3}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$3\frac{1}{8}$	Right	705-131-852	E-852
$\frac{3}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$3\frac{1}{8}$	Left	705-132-852	E-852
$\frac{7}{32}$	$\frac{3}{8}$	$\frac{1}{2}$	$3\frac{1}{8}$	Right	705-131-853	E-853
$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$3\frac{1}{8}$	Right	705-131-854	E-854
$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$3\frac{1}{8}$	Left	705-132-854	E-854
$\frac{9}{32}$	$\frac{3}{8}$	$\frac{9}{16}$	$3\frac{1}{8}$	Right	705-131-855	E-855
$\frac{5}{16}$	$\frac{3}{8}$	$\frac{9}{16}$	$3\frac{1}{8}$	Right	705-131-856	E-856
$\frac{5}{16}$	$\frac{3}{8}$	$\frac{9}{16}$	$3\frac{1}{8}$	Left	705-132-856	E-856
$\frac{11}{32}$	$\frac{3}{8}$	$\frac{9}{16}$	$3\frac{1}{8}$	Right	705-131-857	E-857
$\frac{3}{8}$	$\frac{3}{8}$	$\frac{9}{16}$	$3\frac{1}{8}$	Right	705-131-858	E-858
$\frac{3}{8}$	$\frac{3}{8}$	$\frac{9}{16}$	$3\frac{1}{8}$	Left	705-132-858	E-858
$\frac{13}{32}$	$\frac{1}{2}$	$1\frac{3}{16}$	$3\frac{3}{4}$	Right	705-131-859	E-859
$\frac{7}{16}$	$\frac{1}{2}$	$1\frac{3}{16}$	$3\frac{3}{4}$	Right	705-131-860	E-860
$\frac{7}{16}$	$\frac{1}{2}$	$1\frac{3}{16}$	$3\frac{3}{4}$	Left	705-132-860	E-860
$\frac{15}{32}$	$\frac{1}{2}$	$1\frac{3}{16}$	$3\frac{3}{4}$	Right	705-131-861	E-861
$\frac{1}{2}$	$\frac{1}{2}$	$1\frac{3}{16}$	$3\frac{3}{4}$	Right	705-131-862	E-862
$\frac{1}{2}$	$\frac{1}{2}$	$1\frac{3}{16}$	$3\frac{3}{4}$	Left	705-132-862	E-862
$\frac{9}{16}$	$\frac{5}{8}$	$1\frac{1}{8}$	$4\frac{1}{2}$	Right	705-131-864	E-864
$\frac{9}{16}$	$\frac{5}{8}$	$1\frac{1}{8}$	$4\frac{1}{2}$	Left	705-132-864	E-864
$\frac{5}{8}$	$\frac{5}{8}$	$1\frac{1}{8}$	$4\frac{1}{2}$	Right	705-131-866	E-866
$\frac{5}{8}$	$\frac{5}{8}$	$1\frac{1}{8}$	$4\frac{1}{2}$	Left	705-132-866	E-866
$\frac{11}{16}$	$\frac{3}{4}$	$1\frac{1}{16}$	5	Right	705-131-867	E-867
$\frac{3}{4}$	$\frac{3}{4}$	$1\frac{1}{16}$	5	Right	705-131-868	E-868
$\frac{3}{4}$	$\frac{3}{4}$	$1\frac{1}{16}$	5	Left	705-132-868	E-868
$\frac{7}{8}$	$\frac{7}{8}$	$1\frac{9}{16}$	$5\frac{1}{2}$	Right	705-131-869	E-869
1	1	$1\frac{9}{8}$	$5\frac{7}{8}$	Right	705-131-870	E-870

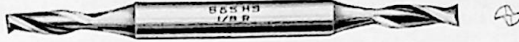
Sizes of Mills listed Right-Hand only are made Left-Hand to order.

Packed one in a box.

Two-Flute Fast Spiral Double-End End Mills are advantageous where rapid cuts are required over great lengths on a large number of pieces. The double-end feature provides twice as many cuts as can be made with a single-end end mill and, also, permits replacement as one end becomes worn and dull, with a minimum of time lost.

Two-Flute Fast Spiral Double-End End Mills

With $\frac{3}{16}$ " Straight Shank

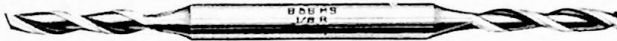


Diameter of End Mill, Inches	Diameter of Shank, Inches	Length of Cut, Inches	Length Overall, Inches	Hand	Order by Number	Old Catalog Number
$\frac{1}{16}$	$\frac{3}{16}$	$\frac{7}{32}$	$2\frac{1}{4}$	Right	705-131-880	E-880
$\frac{3}{32}$	$\frac{3}{16}$	$\frac{5}{16}$	$2\frac{1}{4}$	Right	705-131-882	E-882
$\frac{1}{8}$	$\frac{3}{16}$	$\frac{3}{8}$	$2\frac{1}{4}$	Right	705-131-884	E-884
$\frac{5}{32}$	$\frac{3}{16}$	$\frac{7}{16}$	$2\frac{1}{4}$	Right	705-131-886	E-886
$\frac{3}{16}$	$\frac{3}{16}$	$\frac{1}{2}$	$2\frac{1}{4}$	Right	705-131-888	E-888

*Left-Hand Mills made to order.
Packed one dozen in a box.

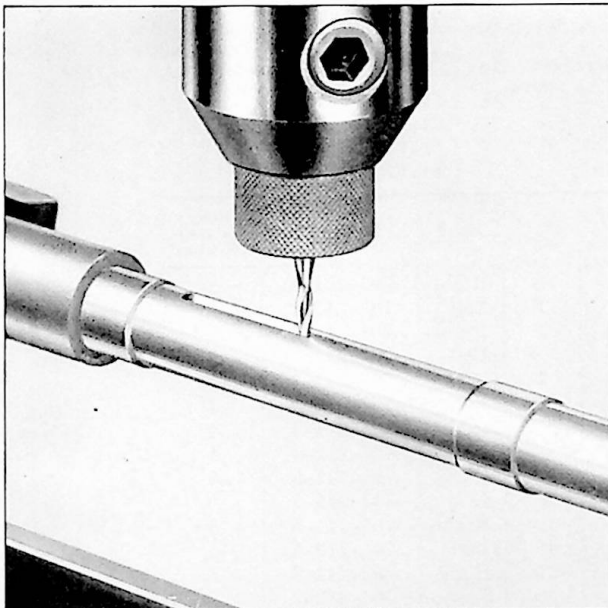
Long, Two-Flute Fast Spiral Double-End End Mills

With $\frac{3}{16}$ " Straight Shank



Diameter of End Mill, Inches	Diameter of Shank, Inches	Length Below Shank, Inches	Length of Cut, Inches	Length Overall, Inches	Hand	Order by Number	Old Catalog Number
$\frac{1}{16}$	$\frac{3}{16}$	$\frac{3}{8}$	$\frac{7}{32}$	$2\frac{1}{2}$	Right	705-131-910	E-910
$\frac{3}{32}$	$\frac{3}{16}$	$\frac{1}{2}$	$\frac{9}{32}$	$2\frac{5}{8}$	Right	705-131-912	E-912
$\frac{1}{8}$	$\frac{3}{16}$	$\frac{3}{4}$	$\frac{3}{4}$	$3\frac{1}{8}$	Right	705-131-914	E-914
$\frac{3}{16}$	$\frac{3}{16}$	1	1	$3\frac{3}{8}$	Right	705-131-916	E-916

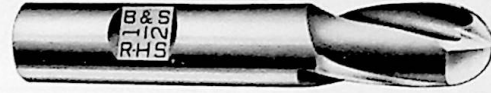
*Left-Hand Mills made to order.
Packed one dozen in a box.



Two-Flute Fast Spiral Double-End End Mill with $\frac{3}{16}$ " Straight Shank, held in a Cutter Adapter Bushing in a Cutter Adapter, milling a keyway with free cutting and accuracy.

Ball End, Two-Flute Fast Spiral Single-End End Mills

With Straight Shank



Mill slots requiring bottom radius and fillets, and bore round-bottom holes.

End Mills with shanks $\frac{7}{8}$ " in diameter and larger differ from illustration; these mills have two holding flats instead of the one shown.

Diameter of End Mill, Inches	Diameter of Shank, Inches	Length of Cut, Inches	Length Overall, Inches	Hand	Order by Number	Old Catalog Number
$\frac{1}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$2\frac{5}{16}$	Right	705-131-985	E-985
$\frac{3}{16}$	$\frac{3}{8}$	$\frac{1}{2}$	$2\frac{3}{8}$	Right	705-131-986	E-986
$\frac{1}{4}$	$\frac{3}{8}$	$\frac{5}{8}$	$2\frac{7}{16}$	Right	705-131-987	E-987
$\frac{5}{16}$	$\frac{3}{8}$	$\frac{3}{4}$	$2\frac{1}{2}$	Right	705-131-988	E-988
$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{4}$	$2\frac{1}{2}$	Right	705-131-989	E-989
$\frac{7}{16}$	$\frac{1}{2}$	1	3	Right	705-131-990	E-990
$\frac{1}{2}$	$\frac{1}{2}$	1	3	Right	705-131-991	E-991
$\frac{5}{8}$	$\frac{5}{8}$	$1\frac{3}{8}$	$3\frac{1}{2}$	Right	705-131-992	E-992
$\frac{3}{4}$	$\frac{3}{4}$	$1\frac{5}{8}$	$3\frac{7}{8}$	Right	705-131-993	E-993
$\frac{7}{8}$	$\frac{7}{8}$	2	$4\frac{1}{4}$	Right	705-131-994	E-994
1	1	$2\frac{1}{4}$	$4\frac{3}{4}$	Right	705-131-995	E-995

Left-Hand Mills made to order.
Packed one in a box.



Ball End, Two-Flute Fast Spiral Single-End End Mills simplify the milling of slots or other surfaces requiring bottom radius or fillet, as shown in the illustration.

For Prices, See Separate Section

Shell End Mills

For use with Arbors for Shell End Mills, listed on pages 51 and 52.

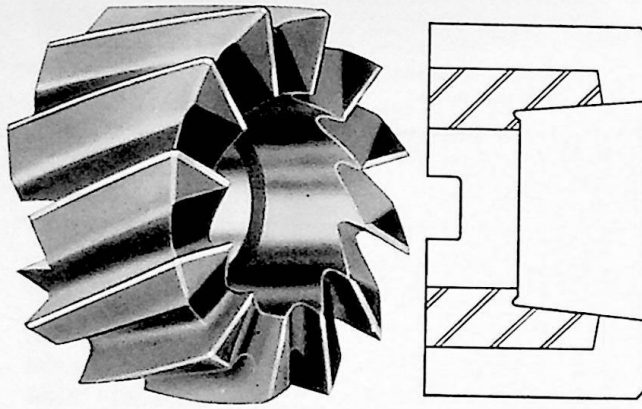


Illustration shows Left-Hand Mill

Shell End Mills are furnished regularly with chamfered corners but mills in the sizes listed can be furnished with sharp corners at the same prices shown in price list.

Shell End Mills with round corners also can be furnished at extra cost.

Diameter, Inches	Length of Cut, Inches	Hole, Inches	No. of Teeth	Hand	Order by Number	Old Catalog Number
1 1/4	1	1/2	8	Right	705-251-225	F-225
1 1/4	1	1/2	8	Left	705-252-225	F-225
1 1/2	1 1/8	1/2	8	Right	705-251-226	F-226
1 1/2	1 1/8	1/2	8	Left	705-252-226	F-226
1 3/4	1 1/4	3/4	8	Right	705-251-227	F-227
1 3/4	1 1/4	3/4	8	Left	705-252-227	F-227
2	1 3/8	3/4	8	Right	705-251-228	F-228
2	1 3/8	3/4	8	Left	705-252-228	F-228
2 1/4	1 1/2	1	10	Right	705-251-229	F-229
2 1/4	1 1/2	1	10	Left	705-252-229	F-229
2 1/2	1 5/8	1	10	Right	705-251-230	F-230
2 1/2	1 5/8	1	10	Left	705-252-230	F-230
2 3/4	1 5/8	1	10	Right	705-251-231	F-231
2 3/4	1 5/8	1	10	Left	705-252-231	F-231
3	1 3/4	1 1/4	10	Right	705-251-232	F-232
3	1 3/4	1 1/4	10	Left	705-252-232	F-232
3 1/2	1 7/8	1 1/4	12	Right	705-251-233	F-233
3 1/2	1 7/8	1 1/4	12	Left	705-252-233	F-233
4	2 1/4	1 1/2	12	Right	705-251-234	F-234
4	2 1/4	1 1/2	12	Left	705-252-234	F-234
4 1/2	2 1/4	1 1/2	14	Right	705-251-235	F-235
4 1/2	2 1/4	1 1/2	14	Left	705-252-235	F-235
5	2 1/4	1 1/2	14	Right	705-251-236	F-236
5	2 1/4	1 1/2	14	Left	705-252-236	F-236
5 1/2	2 1/4	2	16	Right	705-251-237	F-237
5 1/2	2 1/4	2	16	Left	705-252-237	F-237
6	2 1/4	2	16	Right	705-251-238	F-238
6	2 1/4	2	16	Left	705-252-238	F-238

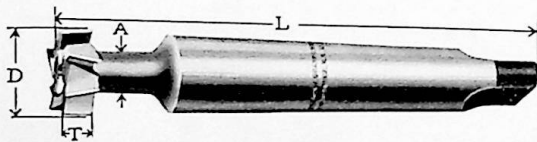


Illustration shows Left-Hand Cutter

Standard T Slot Cutters

With Brown & Sharpe Taper Shank

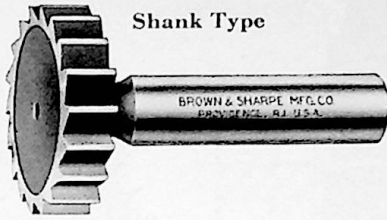
Cutters with No. 5 Taper Shanks have Plain Ends, not Tang End shown.

Bolt Size, Inches	Dia. of Cutter, D, Inches	Width of Cutter, T, Inches	Dia. of Neck, A, Inches	No. of Taper Shank	Whole Length, L, Inches	No. of Teeth	Hand	Order by Number	Old Catalog Number
1/4	9/16	15/64	17/64	5	2 5/8	8	Right	705-211-1	1
1/4	9/16	15/64	17/64	5	2 5/8	8	Left	705-212-1	1
5/16	21/32	17/64	21/64	5	2 23/32	8	Right	705-211-2	2
5/16	21/32	17/64	21/64	5	2 23/32	8	Left	705-212-2	2
3/8	25/32	21/64	13/32	7	4 13/16	8	Right	705-211-3	3
3/8	25/32	21/64	13/32	7	4 13/16	8	Left	705-212-3	3
1/2	31/32	25/64	17/32	7	5	10	Right	705-211-4	4
1/2	31/32	25/64	17/32	7	5	10	Left	705-212-4	4
5/8	1 1/4	31/64	21/32	7	5 1/4	10	Right	705-211-5	5
5/8	1 1/4	31/64	21/32	7	5 1/4	10	Left	705-212-5	5
3/4	1 15/32	5/8	25/32	9	6 7/8	10	Right	705-211-6	6
3/4	1 15/32	5/8	25/32	9	6 7/8	10	Left	705-212-6	6
1	1 27/32	53/64	11/32	9	7 1/4	10	Right	705-211-7	7
1	1 27/32	53/64	11/32	9	7 1/4	10	Left	705-212-7	7
1 1/4	2 7/32	1 3/32	1 9/32	9	7 13/16	10	Right	705-211-8	8
1 1/4	2 7/32	1 3/32	1 9/32	9	7 13/16	10	Left	705-212-8	8
1 1/2	2 21/32	1 11/32	1 17/32	10	10 3/8	12	Right	705-211-9	9
1 1/2	2 21/32	1 11/32	1 17/32	10	10 3/8	12	Left	705-212-9	9

Each of the above packed one in a box.

For Prices, See Separate Section

Woodruff Key Seat Cutters



Shank Type

Numbers of Woodruff Keys correspond to numbers of Woodruff Key Seat Cutters (Shank Type) with the following exceptions:

Key No. 121 requires Cutter No. A or No. 807, Key No. 141 requires Cutter No. 15 or No. 808, Key No. 131 requires Cutter No. B or No. 1008, Key No. 161 requires Cutter No. C or No. 1009.

All Cutters listed have shank 1/2" in diameter.

Diameter, Inches	Thickness, Inches	Length Overall, Inches	No. of Teeth	Hand	Order by Number	Cutter No.	
						American Standard	Old Standard
1/4	1/16	2 1/16	6	Right	705-171-201		201
5/16	1/16	2 1/16	6	Right	705-171-206		206
5/16	3/32	2 3/32	6	Right	705-171-207		207
3/8	1/16	2 1/16	6	Right	705-171-211		211
3/8	3/32	2 3/32	6	Right	705-171-212		212
3/8	1/8	2 1/8	6	Right	705-171-213		213
1/2	1/16	2 1/16	8	Right	705-171-1	204	1
1/2	3/32	2 3/32	8	Right	705-171-2	304	2
5/8	3/32	2 3/32	8	Right	705-171-4	305	4
1/2	1/8	2 1/8	8	Right	705-171-3	404	3
5/8	1/8	2 1/8	8	Right	705-171-5	405	5
3/4	1/8	2 1/8	8	Right	705-171-7	406	7
5/8	5/32	2 5/32	8	Right	705-171-6	505	6
5/8	3/16	2 3/16	8	Right	705-171-61		61
3/4	5/32	2 5/32	8	Right	705-171-8	506	8
3/4	1/4	2 1/4	8	Right	705-171-91		91
7/8	5/32	2 5/32	10	Right	705-171-10	507	10
3/4	3/16	2 3/16	8	Right	705-171-9	606	9
7/8	3/16	2 3/16	10	Right	705-171-11	607	11
7/8	7/32	2 7/32	10	Right	705-171-12		12
1	3/16	2 3/16	10	Right	705-171-13	608	13
1	7/32	2 7/32	10	Right	705-171-14		14
1	3/8	2 3/8	10	Right	705-171-152		152
1 1/8	3/16	2 3/16	10	Right	705-171-16	609	16
7/8	1/4	2 1/4	10	Right	705-171-301	807	A
1	1/4	2 1/4	10	Right	705-171-15	808	15
1 1/8	7/32	2 7/32	10	Right	705-171-17		17
1 1/8	1/4	2 1/4	10	Right	705-171-18	809	18
1 1/4	3/16	2 3/16	10	Right	705-171-19		19
1 1/4	7/32	2 7/32	10	Right	705-171-20		20
1 1/4	1/4	2 1/4	10	Right	705-171-21	810	21
1 3/8	1/4	2 1/4	10	Right	705-171-22	811	22
1 1/2	1/4	2 1/4	12	Right	705-171-24	812	24
1	5/16	2 5/16	10	Right	705-171-302	1008	B
1 1/8	5/16	2 5/16	10	Right	705-171-303	1009	C
1 1/4	5/16	2 5/16	10	Right	705-171-304	1010	D
1 3/8	5/16	2 5/16	10	Right	705-171-23	1011	23
1 1/2	5/16	2 5/16	12	Right	705-171-25	1012	25
1 1/4	3/8	2 3/8	10	Right	705-171-305	1210	E
1 3/8	3/8	2 3/8	10	Right	705-171-306	1211	F
1 1/2	3/8	2 3/8	12	Right	705-171-307	1212	G

Left-Hand Cutters made to order.

Each of the above packed one in a box.

Woodruff Key Seat Cutters

Arbor Type

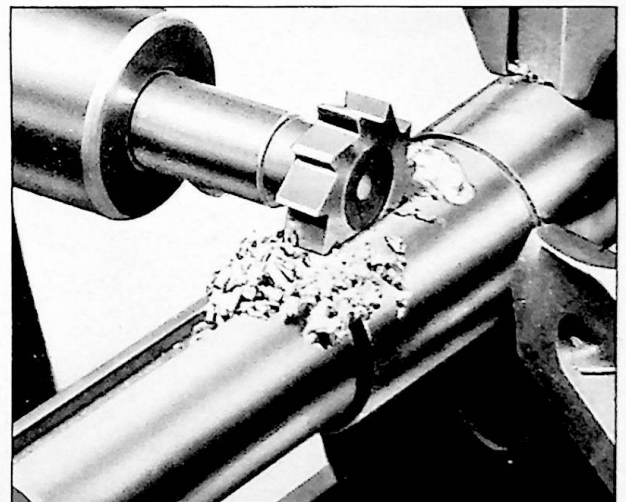


Diameters of cutters are 1/32" larger than nominal diameters listed, to allow for sharpening.

Key No.	Nominal Diameter of Cutter, Inches	Width of Face, Inches	Hole, Inches	No. of Teeth	Order by Number	Cutter No.
26, 126	2 1/8	3/16	3/4	12	705-170-26	26
27, 127	2 1/8	1/4	3/4	12	705-170-27	27
28, 128	2 1/8	5/16	3/4	12	705-170-28	28
29, 129	2 1/8	3/8	3/4	12	705-170-29	29
R, RX	2 3/4	1/4	1	14	705-170-318	R
S, SX	2 3/4	5/16	1	14	705-170-319	S
T, TX	2 3/4	3/8	1	14	705-170-320	T
U, UX	2 3/4	7/16	1	14	705-170-321	U
V, VX	2 3/4	1/2	1	14	705-170-322	V
30	3 1/2	3/8	1	16		30
31	3 1/2	7/16	1	16		31
32	3 1/2	1/2	1	16		32
33	3 1/2	9/16	1	16		33
34	3 1/2	5/8	1	16		34
35	3 1/2	11/16	1	16		35
36	3 1/2	3/4	1	16		36

Order by Catalog Description

List of Keyways, page 32.



Woodruff Key Seat Cutters mill accurately key slots conforming to the circular shape of Woodruff Keys.

For Prices, See Separate Section

Angular Cutters

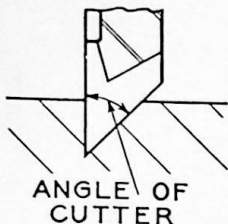
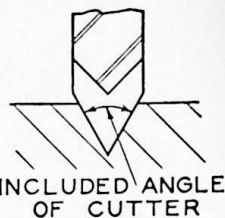
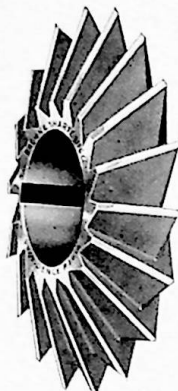


Illustration shows Left-Hand Cutter

Made with 45° or 60° angle.

Diam-eter, Inches	Thick-ness, Inches	Hole, Inches	No. of Teeth	An-gle, De-grees	Hand	Order by Number	Old Catalog Number
2 1/2	1/2	7/8	16	45	Right	705-291-410	J-10
2 1/2	1/2	7/8	16	45	Left	705-292-410	J-10
2 1/2	1/2	7/8	16	60	Right	705-291-610	J-10
2 1/2	1/2	7/8	16	60	Left	705-292-610	J-10
2 3/4	1/2	1	18	45	Right	705-291-411	J-11
2 3/4	1/2	1	18	45	Left	705-292-411	J-11
2 3/4	1/2	1	18	60	Right	705-291-611	J-11
2 3/4	1/2	1	18	60	Left	705-292-611	J-11
3	1/2	1 1/4	20	45	Right	705-291-412	J-12
3	1/2	1 1/4	20	45	Left	705-292-412	J-12
3	1/2	1 1/4	20	60	Right	705-291-612	J-12
3	1/2	1 1/4	20	60	Left	705-292-612	J-12

Double Angle Cutters



Made with 45°, 60° or 90° included angle.

Diam-eter, Inches	Thick-ness, Inches	Hole, Inches	No. of Teeth	Angle, Degrees	Order by Number	Old Catalog Number
2 3/4	1/2	1	18	45	705-290-4101	J-101
2 3/4	1/2	1	18	60	705-290-6101	J-101
2 3/4	1/2	1	18	90	705-290-9101	J-101

Angular Cutters and Cutters for Spiral Mills

With Backed-Off Teeth

Can be sharpened by grinding without changing their form.
Made to order.

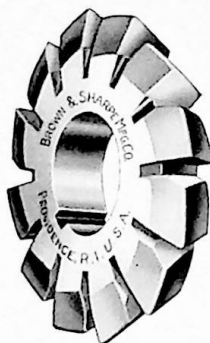


Illustration shows Left-Hand Cutter

Angular Cutters with Threaded Holes

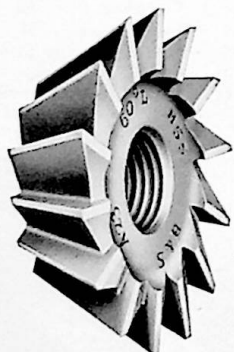


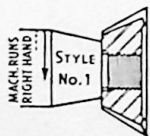
Illustration shows Left-Hand Cutter

Made with 60° angle.

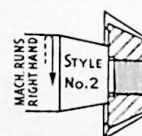
Diameter, Inches	Thickness, Inches	Threaded Hole	No. of Teeth	Hand	Order by Number	Old Catalog Number
1 1/4	1/16	3/8" 24 N.F., L.H.	12	Right	705-291-635	J-35
1 1/4	1/16	3/8" 24 N.F., L.H.	12	Left	705-292-635	J-35
1 5/8	1/16	1/2" 20 N.F., L.H.	14	Right	705-291-636	J-36
1 5/8	1/16	1/2" 20 N.F., L.H.	14	Left	705-292-636	J-36
1 1/4	1/16	3/8" 24 N.F., R.H.	12	Right	705-291-637	J-37
1 1/4	1/16	3/8" 24 N.F., R.H.	12	Left	705-292-637	J-37
1 5/8	1/16	1/2" 20 N.F., R.H.	14	Right	705-291-638	J-38
1 5/8	1/16	1/2" 20 N.F., R.H.	14	Left	705-292-638	J-38

Each of the above packed one in a box.

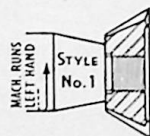
Determining the Hand of an Angular Cutter



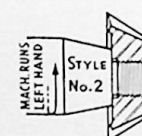
Right-Hand Cutter
Right-Hand Thread



Left-Hand Cutter
Right-Hand Thread



Left-Hand Cutter
Left-Hand Thread

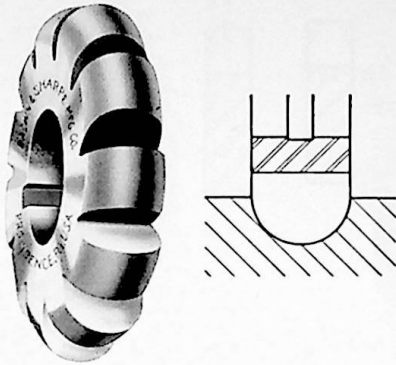


Right-Hand Cutter
Left-Hand Thread

For Prices, See Separate Section

List of Keyways, page 32.

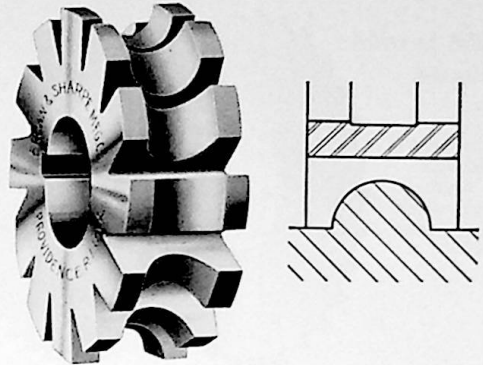
Convex Cutters
For Milling Half Circles



These cutters can be sharpened by grinding without changing their outline.

Diam. of Circle, Inches	Diam. of Cutter, Inches	Hole, Inches	No. of Teeth	Order by Number	Old Catalog Number
1/8	2	7/8	14	705-330-10	C-10
3/16	2	7/8	13	705-330-11	C-11
1/4	2	7/8	13	705-330-12	C-12
5/16	2 1/4	7/8	12	705-330-13	C-13
3/8	2 1/4	7/8	12	705-330-14	C-14
7/16	2 1/4	7/8	11	705-330-15	C-15
1/2	2 1/4	7/8	11	705-330-16	C-16
5/8	2 3/4	1	10	705-330-17	C-17
3/4	3	1	10	705-330-18	C-18
7/8	3 1/4	1	10	705-330-19	C-19
1	3 1/4	1	10	705-330-20	C-20

Concave Cutters
For Milling Half Circles



These cutters can be sharpened by grinding without changing their outline.

Diam. of Circle, Inches	Diam. of Cutter, Inches	Hole, Inches	No. of Teeth	Order by Number	Old Catalog Number
1/8	2	7/8	14	705-370-10	D-10
3/16	2	7/8	13	705-370-11	D-11
1/4	2	7/8	13	705-370-12	D-12
5/16	2 1/4	7/8	12	705-370-13	D-13
3/8	2 1/4	7/8	12	705-370-14	D-14
7/16	2 1/4	7/8	11	705-370-15	D-15
1/2	2 1/4	7/8	11	705-370-16	D-16
5/8	2 3/4	1	10	705-370-17	D-17
3/4	3	1	10	705-370-18	D-18
7/8	3 1/4	1	10	705-370-19	D-19
1	3 1/4	1	10	705-370-20	D-20

Corner-Rounding Cutters

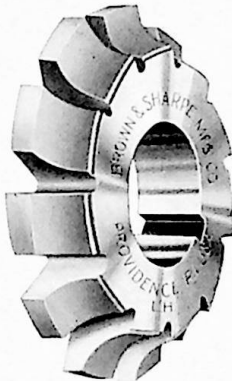


Illustration shows Left-Hand Cutter

These cutters have side as well as radial clearance and can be sharpened by grinding without changing their outline.

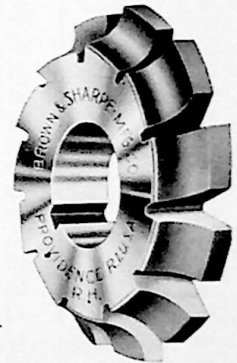
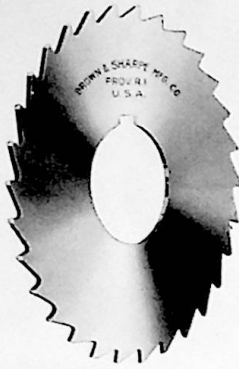


Illustration shows Right-Hand Cutter

Radius of Circle, Inches	Diameter, Inches	Hole, Inches	No. of Teeth	Hand	Order by Number	Old Catalog Number
1/8	2	7/8	13	Right	705-331-102	C-102
1/8	2	7/8	13	Left	705-332-102	C-102
1/4	2 1/4	7/8	11	Right	705-331-106	C-106
1/4	2 1/4	7/8	11	Left	705-332-106	C-106
3/8	3	1	10	Right	705-331-108	C-108
3/8	3	1	10	Left	705-332-108	C-108
1/2	3 1/4	1	10	Right	705-331-110	C-110
1/2	3 1/4	1	10	Left	705-332-110	C-110
5/8	3 1/2	1	10	Right	705-331-112	C-112
5/8	3 1/2	1	10	Left	705-332-112	C-112

Each of the above packed one in a box.

Metal Slitting Saws



Ground on sides and left a little thicker at the outer edge than near center to give proper clearance in cutting deep slots.

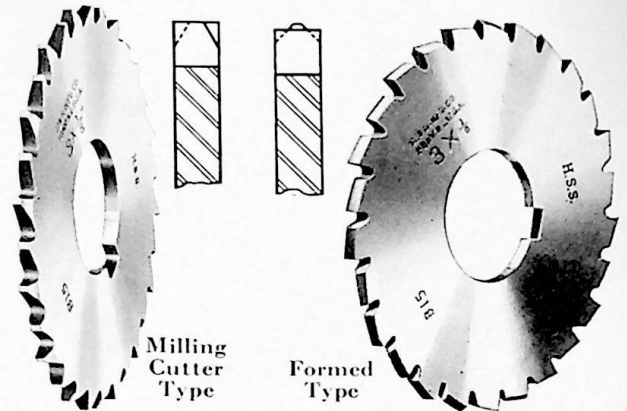
Diameter, Inches	Thickness, Inches	Hole, Inches	No. of Teeth	Order by Number	Old Catalog Number
2 1/2	1/32	7/8	28	705-410-50	G-50
2 1/2	3/64	7/8	28	705-410-51	G-51
2 1/2	1/16	7/8	28	705-410-52	G-52
2 1/2	3/32	7/8	28	705-410-53	G-53
2 1/2	1/8	7/8	28	705-410-54	G-54
3	1/32	1	30	705-410-56	G-56
3	3/64	1	30	705-410-57	G-57
3	1/16	1	30	705-410-58	G-58
3	3/32	1	30	705-410-59	G-59
3	1/8	1	30	705-410-60	G-60
3	3/32	1	30	705-410-61	G-61
4	1/32	1	36	705-410-62	G-62
4	3/64	1	36	705-410-63	G-63
4	1/16	1	36	705-410-64	G-64
4	3/32	1	36	705-410-65	G-65
4	1/8	1	36	705-410-66	G-66
4	3/32	1	36	705-410-67	G-67
4	3/16	1	36	705-410-68	G-68
5	1/16	1	40	705-410-69	G-69
5	3/32	1	40	705-410-70	G-70
5	1/8	1	40	705-410-71	G-71
5	1/8	1 1/4	40	705-410-72	G-72
5	3/32	1	40	705-410-74	G-74
5	3/16	1	40	705-410-75	G-75
6	1/16	1	42	705-410-76	G-76
6	3/32	1	42	705-410-77	G-77
6	1/8	1	42	705-410-78	G-78
6	1/8	1 1/4	42	705-410-78-1	G-78A
6	3/16	1	42	705-410-80	G-80
6	3/16	1 1/4	42	705-410-81	G-81
8	1/8	1	46	705-410-84	G-84
8	1/8	1 1/4	46	705-410-85	G-85
8	3/16	1 1/4	46	705-410-86	G-86

Each of the above packed one in an envelope.

In ordering special saws, state for what purpose they are required.

For Prices, See Separate Section

Saws for Slitting Soft Metals



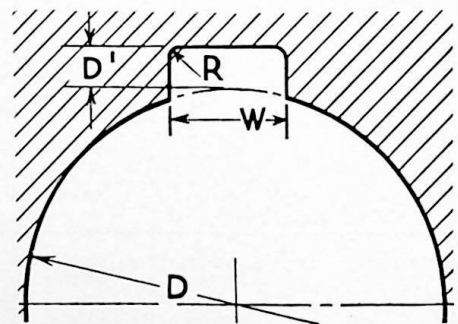
These saws have teeth designed to slit or saw freely metals of a soft or tenacious character with less tendency to clog and score than regular saws.

We can furnish saws in either of two types; the milling cutter type which has the opposite corners of alternate teeth chamfered, or the formed type where each alternate tooth is V shaped, the point of the V extending beyond the cutting edges of the straight teeth. (See line sketches showing tooth sections.) Both types produce chips which are less than the width of the slot being cut, practically eliminating all tendency for the chips to clog.

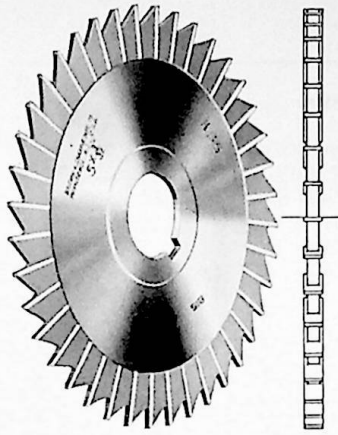
The milling cutter type is sharpened with approximately twice the normal amount of clearance. The formed type is sharpened only on the face. The sides of these saws are ground concave to prevent rubbing.

Made to order in any desired size.

Standard Keyways for Cutters

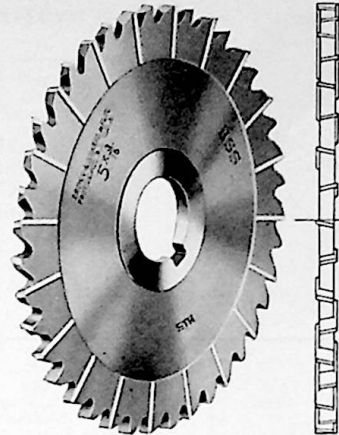


Diam. (D) of Hole, Inches	Width (W) of Keyway, Inches	Depth (D') of Keyway, Inches	Radius (R), Inches	Diam. (D) of Hole, Inches	Width (W) of Keyway, Inches	Depth (D') of Keyway, Inches	Radius (R), Inches
1/2	3/32	3/64	.020	1 1/2	3/8	5/32	1/16
5/8	1/8	1/16	1/32	1 3/4	7/16	3/16	1/16
3/4	1/8	1/16	1/32	2	1/2	3/16	1/16
7/8	1/8	1/16	1/32	2 1/4	5/8	7/32	1/16
1	1/4	3/32	3/64	2 1/2	5/8	7/32	1/16
1 1/4	5/16	1/8	1/16	2 3/4	3/4	1/4	1/16



Metal Slitting Saws

With Side Chip Clearance

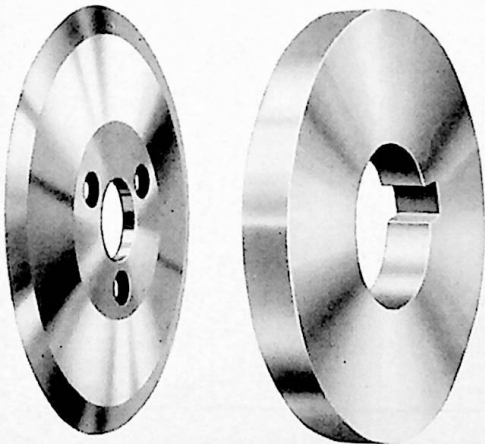


Metal Slitting Saws

With Staggered Teeth and Side Chip Clearance

Diam., Inches	Thick-ness, Inches	Hole, Inches	No. of Teeth	Order by Number	Old Catalog Number
2 1/4	1/16	7/8	28	705-410-225	G-225
2 1/2	3/32	7/8	28	705-410-226	G-226
2 1/2	1/8	7/8	28	705-410-227	G-227
3	1/16	1	30	705-410-235	G-235
3	3/32	1	30	705-410-236	G-236
3	1/8	1	30	705-410-237	G-237
3	3/32	1	30	705-410-238	G-238
4	1/16	1	36	705-410-245	G-245
4	3/32	1	36	705-410-246	G-246
4	1/8	1	36	705-410-247	G-247
4	3/32	1	36	705-410-248	G-248
4	3/16	1	36	705-410-249-1	G-249-1
5	1/16	1	40	705-410-254	G-254
5	3/32	1	40	705-410-255	G-255
5	1/8	1	40	705-410-256	G-256
5	1/8	1 1/4	40	705-410-256-1	G-256-1
5	3/32	1	40	705-410-257	G-257
5	3/16	1	40	705-410-258-1	G-258-1
6	1/16	1	42	705-410-263	G-263
6	3/32	1	42	705-410-264	G-264
6	1/8	1	42	705-410-265	G-265
6	1/8	1 1/4	42	705-410-266	G-266
6	3/16	1	42	705-410-267-1	G-267-1
6	3/16	1 1/4	42	705-410-268-1	G-268-1
8	1/8	1	46	705-410-285	G-285
8	1/8	1 1/4	46	705-410-286	G-286
8	3/16	1 1/4	46	705-410-288-1	G-288-1

Diam-eter, Inches	Thick-ness, Inches	Hole, Inches	No. of Teeth	Order by Number	Old Catalog Number
3	3/16	1	30	705-410-308	G-308
4	3/16	1	36	705-410-322	G-322 Formerly G-249
5	3/16	1	40	705-410-336	G-336 Formerly G-258
5	1/4	1	40	705-410-340	G-340
6	3/16	1	42	705-410-350	G-350 Formerly G-267
6	3/16	1 1/4	42	705-410-351	G-351 Formerly G-268
6	1/4	1	42	705-410-354	G-354
6	1/4	1 1/4	42	705-410-355	G-355
8	3/16	1 1/4	46	705-410-364	G-364 Formerly G-288
8	1/4	1 1/4	46	705-410-368	G-368



List of Keyways, opposite page.



Rotary Shears

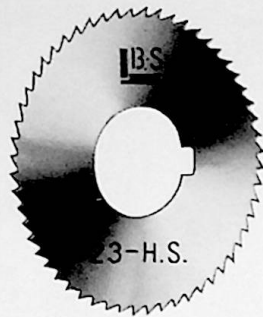
Rotary Shears are used for the stripping or slitting of thin metal, rubber, leather, paper and similar materials. They are made in several styles, some of which are shown at left and can be furnished individually and in gangs. The nature of the work required of the Shears generally determines their design and the kind of steel used in their manufacture.

Brown & Sharpe Shears are heat-treated carefully and ground accurately to size. The steel used is selected to provide best results for the particular requirements of the work which the Shears are to do.

Shears are made to order to customers' specifications.

In ordering, give complete specifications including diameter, thickness, form, size of hole and the use for which the shears are intended.

For Prices, See Separate Section



Screw Slotting Cutters

The teeth of these cutters have a fine pitch especially adapting them to the slotting of screw heads and similar work. They are made in Carbon and High Speed Steels. High Speed Steel Cutters only have ground sides.

Gage No. American Standard	Thickness, Inches	Diameter, Inches	Hole, Inches	No. of Teeth	Steel	Order by Number	Old Catalog Number	Gage No. American Standard	Thickness, Inches	Diameter, Inches	Hole, Inches	No. of Teeth	Steel	Order by Number	Old Catalog Number
5	.182	2 3/4	1	56	H.S.	705-450-5610	H-10	15	.057	2 3/4	1	56	H.S.	705-450-5620	H-20
5	.182	2 3/4	1	72	H.S.	705-450-810	H-10	15	.057	2 3/4	1	72	H.S.	705-450-820	H-20
6	.162	2 3/4	1	56	H.S.	705-450-5611	H-11	16	.051	2 3/4	1/2	72	Carbon	705-456-421	H-21
6	.162	2 3/4	1	72	H.S.	705-450-811	H-11	16	.051	2 3/4	5/8	72	Carbon	705-456-521	H-21
7	.144	2 3/4	1	56	H.S.	705-450-5612	H-12	16	.051	2 3/4	3/4	72	Carbon	705-456-621	H-21
7	.144	2 3/4	1	72	H.S.	705-450-812	H-12	16	.051	2 3/4	3/4	72	H.S.	705-450-621	H-21
8	.128	2 3/4	3/4	72	Carbon	705-456-613	H-13	16	.051	2 3/4	1	72	Carbon	705-456-821	H-21
8	.128	2 3/4	3/4	72	H.S.	705-450-613	H-13	16	.051	2 3/4	1	56	H.S.	705-450-5621	H-21
8	.128	2 3/4	1	72	Carbon	705-456-813	H-13	16	.051	2 3/4	1	72	H.S.	705-450-821	H-21
8	.128	2 3/4	1	56	H.S.	705-450-5613	H-13	17	.045	2 3/4	1/2	72	Carbon	705-456-122	H-22
8	.128	2 3/4	1	72	H.S.	705-450-813	H-13	17	.045	2 3/4	5/8	72	Carbon	705-456-522	H-22
9	.114	2 3/4	3/4	72	Carbon	705-456-614	H-14	17	.045	2 3/4	3/4	72	Carbon	705-456-622	H-22
9	.114	2 3/4	3/4	72	H.S.	705-450-614	H-14	17	.045	2 3/4	3/4	72	H.S.	705-450-622	H-22
9	.114	2 3/4	1	72	Carbon	705-456-814	H-14	17	.045	2 3/4	1	72	Carbon	705-456-822	H-22
9	.114	2 3/4	1	56	H.S.	705-450-5614	H-14	17	.045	2 3/4	1	56	H.S.	705-450-5622	H-22
9	.114	2 3/4	1	72	H.S.	705-450-814	H-14	17	.045	2 3/4	1	72	H.S.	705-450-822	H-22
10	.102	2 3/4	3/4	72	Carbon	705-456-615	H-15	18	.040	2 3/4	1/2	72	Carbon	705-456-123	H-23
10	.102	2 3/4	3/4	72	H.S.	705-450-615	H-15	18	.040	2 3/4	5/8	72	Carbon	705-456-523	H-23
10	.102	2 3/4	1	72	Carbon	705-456-815	H-15	18	.040	2 3/4	3/4	72	Carbon	705-456-623	H-23
10	.102	2 3/4	1	56	H.S.	705-450-5615	H-15	18	.040	2 3/4	3/4	72	H.S.	705-450-623	H-23
10	.102	2 3/4	1	72	H.S.	705-450-815	H-15	18	.040	2 3/4	1	72	Carbon	705-456-823	H-23
11	.091	2 3/4	3/4	72	Carbon	705-456-616	H-16	18	.040	2 3/4	1	56	H.S.	705-450-5623	H-23
11	.091	2 3/4	3/4	72	H.S.	705-450-616	H-16	18	.040	2 3/4	1	72	H.S.	705-450-823	H-23
11	.091	2 3/4	1	72	Carbon	705-456-816	H-16	19	.036	2 3/4	1/2	72	Carbon	705-456-124	H-24
11	.091	2 3/4	1	56	H.S.	705-450-5616	H-16	19	.036	2 3/4	5/8	72	Carbon	705-456-524	H-24
11	.091	2 3/4	1	72	H.S.	705-450-816	H-16	19	.036	2 3/4	3/4	72	Carbon	705-456-624	H-24
12	.081	2 3/4	3/4	72	Carbon	705-456-617	H-17	19	.036	2 3/4	3/4	72	H.S.	705-450-624	H-24
12	.081	2 3/4	3/4	72	H.S.	705-450-617	H-17	19	.036	2 3/4	1	72	Carbon	705-456-824	H-24
12	.081	2 3/4	1	72	Carbon	705-456-817	H-17	19	.036	2 3/4	1	56	H.S.	705-450-5624	H-24
12	.081	2 3/4	1	56	H.S.	705-450-5617	H-17	19	.036	2 3/4	1	72	H.S.	705-450-824	H-24
12	.081	2 3/4	1	72	H.S.	705-450-817	H-17	20	.032	2 3/4	1/2	72	Carbon	705-456-125	H-25
13	.072	2 3/4	3/4	72	Carbon	705-456-618	H-18	20	.032	2 3/4	5/8	72	Carbon	705-456-525	H-25
13	.072	2 3/4	3/4	72	H.S.	705-450-618	H-18	20	.032	2 3/4	3/4	72	Carbon	705-456-625	H-25
13	.072	2 3/4	1	72	Carbon	705-456-818	H-18	20	.032	2 3/4	3/4	72	H.S.	705-450-625	H-25
13	.072	2 3/4	1	56	H.S.	705-450-5618	H-18	20	.032	2 3/4	1	72	Carbon	705-456-825	H-25
13	.072	2 3/4	1	72	H.S.	705-450-818	H-18	20	.032	2 3/4	1	56	H.S.	705-450-5625	H-25
14	.064	2 3/4	1/2	72	Carbon	705-456-419	H-19	20	.032	2 3/4	1	72	H.S.	705-450-825	H-25
14	.064	2 3/4	5/8	72	Carbon	705-456-519	H-19	21	.028	2 3/4	1/2	72	Carbon	705-456-126	H-26
14	.064	2 3/4	3/4	72	Carbon	705-456-619	H-19	21	.028	2 3/4	5/8	72	Carbon	705-456-526	H-26
14	.064	2 3/4	3/4	72	H.S.	705-450-619	H-19	21	.028	2 3/4	3/4	72	Carbon	705-456-626	H-26
14	.064	2 3/4	1	72	Carbon	705-456-819	H-19	21	.028	2 3/4	3/4	72	H.S.	705-450-626	H-26
14	.064	2 3/4	1	56	H.S.	705-450-5619	H-19	21	.028	2 3/4	1	72	Carbon	705-456-826	H-26
14	.064	2 3/4	1	72	H.S.	705-450-819	H-19	21	.028	2 3/4	1	56	H.S.	705-450-5626	H-26
15	.057	2 3/4	1/2	72	Carbon	705-456-420	H-20	21	.028	2 3/4	1	72	H.S.	705-450-826	H-26
15	.057	2 3/4	5/8	72	Carbon	705-456-520	H-20	22	.025	2 3/4	1/2	72	Carbon	705-456-127	H-27
15	.057	2 3/4	3/4	72	Carbon	705-456-620	H-20	22	.025	2 3/4	5/8	72	Carbon	705-456-527	H-27
15	.057	2 3/4	3/4	72	H.S.	705-450-620	H-20	22	.025	2 3/4	3/4	72	Carbon	705-456-627	H-27
15	.057	2 3/4	1	72	Carbon	705-456-820	H-20	22	.025	2 3/4	3/4	72	H.S.	705-450-627	H-27

Cutters of Gage No. 5 are packed 10 in a box; of Gages Nos. 6 through 12 inclusive, 2 3/4" diameter, are packed 12 in a box. All others are packed 25 in a box.

For Prices, See Separate Section

List of Keyways, page 32.

Screw Slotting Cutters (Cont'd)

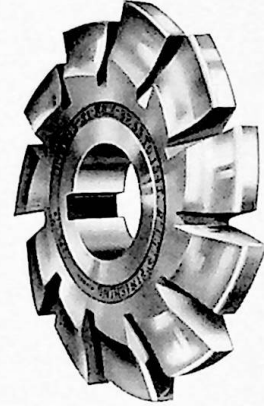
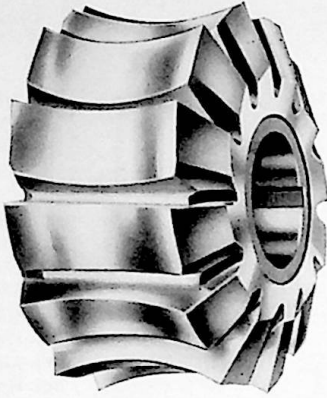
Gage No. American Standard	Thickness, Inches	Diameter, Inches	Hole, Inches	No. of Teeth	Steel	Order by Number	Old Catalog Number	Gage No. American Standard	Thickness, Inches	Diameter, Inches	Hole, Inches	No. of Teeth	Steel	Order by Number	Old Catalog Number
22	.025	2 3/4	1	72	Carbon	705-456-827	H-27	22	.025	2 1/4	5/8	60	H.S.	705-450-539	H-39
22	.025	2 3/4	1	56	H.S.	705-450-5627	H-27	23	.023	2 1/4	5/8	60	Carbon	705-456-540	H-40
22	.025	2 3/4	1	72	H.S.	705-450-827	H-27	23	.023	2 1/4	5/8	60	H.S.	705-450-540	H-40
23	.023	2 3/4	1/2	72	Carbon	705-456-428	H-28	24	.020	2 1/4	5/8	60	Carbon	705-456-541	H-41
23	.023	2 3/4	5/8	72	Carbon	705-456-528	H-28	24	.020	2 1/4	5/8	60	H.S.	705-450-541	H-41
23	.023	2 3/4	3/4	72	Carbon	705-456-628	H-28	25	.018	2 1/4	5/8	60	Carbon	705-456-542	H-42
23	.023	2 3/4	3/4	72	H.S.	705-450-628	H-28	26	.016	2 1/4	5/8	60	Carbon	705-456-543	H-43
23	.023	2 3/4	1	72	Carbon	705-456-828	H-28	27	.014	2 1/4	5/8	60	Carbon	705-456-544	H-44
23	.023	2 3/4	1	72	H.S.	705-450-828	H-28	28	.013	2 1/4	5/8	60	Carbon	705-456-545	H-45
24	.020	2 3/4	1/2	72	Carbon	705-456-429	H-29	30	.010	2 1/4	5/8	60	Carbon	705-456-546	H-46
24	.020	2 3/4	5/8	72	Carbon	705-456-529	H-29	32	.008	2 1/4	5/8	60	Carbon	705-456-547	H-47
24	.020	2 3/4	3/4	72	Carbon	705-456-629	H-29	34	.006	2 1/4	5/8	60	Carbon	705-456-548	H-48
24	.020	2 3/4	3/4	72	H.S.	705-450-629	H-29	14	.064	1 3/4	5/8	90	Carbon	705-456-549	H-49
24	.020	2 3/4	1	72	Carbon	705-456-829	H-29	14	.064	1 3/4	5/8	90	H.S.	705-450-549	H-49
24	.020	2 3/4	1	72	H.S.	705-450-829	H-29	15	.057	1 3/4	5/8	90	Carbon	705-456-550	H-50
25	.018	2 3/4	1/2	72	Carbon	705-456-430	H-30	15	.057	1 3/4	5/8	90	H.S.	705-450-550	H-50
25	.018	2 3/4	5/8	72	Carbon	705-456-530	H-30	16	.051	1 3/4	5/8	90	Carbon	705-456-551	H-51
25	.018	2 3/4	3/4	72	Carbon	705-456-630	H-30	16	.051	1 3/4	5/8	90	H.S.	705-450-551	H-51
25	.018	2 3/4	1	72	Carbon	705-456-830	H-30	17	.045	1 3/4	5/8	90	Carbon	705-456-552	H-52
26	.016	2 3/4	3/4	72	Carbon	705-456-631	H-31	17	.045	1 3/4	5/8	90	H.S.	705-450-552	H-52
26	.016	2 3/4	1	72	Carbon	705-456-831	H-31	18	.040	1 3/4	5/8	90	Carbon	705-456-553	H-53
27	.014	2 3/4	3/4	72	Carbon	705-456-632	H-32	18	.040	1 3/4	5/8	90	H.S.	705-450-553	H-53
27	.014	2 3/4	1	72	Carbon	705-456-832	H-32	19	.036	1 3/4	5/8	90	Carbon	705-456-554	H-54
28	.013	2 3/4	3/4	72	Carbon	705-456-633	H-33	19	.036	1 3/4	5/8	90	H.S.	705-450-554	H-54
28	.013	2 3/4	1	72	Carbon	705-456-833	H-33	20	.032	1 3/4	5/8	90	Carbon	705-456-555	H-55
30	.010	2 3/4	3/4	72	Carbon	705-456-634	H-34	20	.032	1 3/4	5/8	90	H.S.	705-450-555	H-55
30	.010	2 3/4	1	72	Carbon	705-456-834	H-34	21	.028	1 3/4	5/8	90	Carbon	705-456-556	H-56
32	.008	2 3/4	3/4	72	Carbon	705-456-635	H-35	21	.028	1 3/4	5/8	90	H.S.	705-450-556	H-56
32	.008	2 3/4	1	72	Carbon	705-456-835	H-35	22	.025	1 3/4	5/8	90	Carbon	705-456-557	H-57
34	.006	2 3/4	3/4	72	Carbon	705-456-636	H-36	22	.025	1 3/4	5/8	90	H.S.	705-450-557	H-57
34	.006	2 3/4	1	72	Carbon	705-456-836	H-36	23	.023	1 3/4	5/8	90	Carbon	705-456-558	H-58
10	.102	2 1/4	5/8	60	Carbon	705-456-536-1	H-36 A	23	.023	1 3/4	5/8	90	H.S.	705-450-558	H-58
11	.091	2 1/4	5/8	60	Carbon	705-456-536-2	H-36 B	24	.020	1 3/4	1/2	90	Carbon	705-456-459	H-59
12	.081	2 1/4	5/8	60	Carbon	705-456-536-3	H-36 C	24	.020	1 3/4	5/8	90	Carbon	705-456-559	H-59
13	.072	2 1/4	5/8	60	Carbon	705-456-536-4	H-36 D	24	.020	1 3/4	5/8	90	H.S.	705-450-559	H-59
14	.064	2 1/4	5/8	60	Carbon	705-456-536-5	H-36 E	25	.018	1 3/4	1/2	90	Carbon	705-456-460	H-60
14	.064	2 1/4	5/8	60	H.S.	705-450-536-5	H-36 E	25	.018	1 3/4	5/8	90	Carbon	705-456-560	H-60
15	.057	2 1/4	5/8	60	Carbon	705-456-536-6	H-36 F	25	.018	1 3/4	5/8	90	H.S.	705-450-560	H-60
15	.057	2 1/4	5/8	60	H.S.	705-450-536-6	H-36 F	26	.016	1 3/4	1/2	90	Carbon	705-456-461	H-61
16	.051	2 1/4	5/8	60	Carbon	705-456-536-7	H-36 G	26	.016	1 3/4	5/8	90	Carbon	705-456-561	H-61
16	.051	2 1/4	5/8	60	H.S.	705-450-536-7	H-36 G	26	.016	1 3/4	5/8	90	H.S.	705-450-561	H-61
17	.045	2 1/4	5/8	60	Carbon	705-456-536-8	H-36 H	27	.014	1 3/4	1/2	90	Carbon	705-456-462	H-62
17	.045	2 1/4	5/8	60	H.S.	705-450-536-8	H-36 H	27	.014	1 3/4	5/8	90	Carbon	705-456-562	H-62
18	.040	2 1/4	5/8	60	Carbon	705-456-536-9	H-36 I	27	.014	1 3/4	5/8	90	H.S.	705-450-562	H-62
18	.040	2 1/4	5/8	60	H.S.	705-450-536-9	H-36 I	28	.013	1 3/4	1/2	90	Carbon	705-456-463	H-63
19	.036	2 1/4	5/8	60	Carbon	705-456-536-10	H-36 J	28	.013	1 3/4	5/8	90	Carbon	705-456-563	H-63
19	.036	2 1/4	5/8	60	H.S.	705-450-536-10	H-36 J	30	.010	1 3/4	1/2	90	Carbon	705-456-464	H-64
20	.032	2 1/4	5/8	60	Carbon	705-456-537	H-37	30	.010	1 3/4	5/8	90	Carbon	705-456-564	H-64
20	.032	2 1/4	5/8	60	H.S.	705-450-537	H-37	32	.008	1 3/4	1/2	90	Carbon	705-456-465	H-65
21	.028	2 1/4	5/8	60	Carbon	705-456-538	H-38	32	.008	1 3/4	5/8	90	Carbon	705-456-565	H-65
21	.028	2 1/4	5/8	60	H.S.	705-450-538	H-38	34	.006	1 3/4	1/2	90	Carbon	705-456-466	H-66
22	.025	2 1/4	5/8	60	Carbon	705-456-539	H-39	34	.006	1 3/4	5/8	90	Carbon	705-456-566	H-66

Cutters of Gages Nos. 10 through 12 inclusive, 2 1/4" diameter, are packed 12 in a box.
All others are packed 25 in a box.

Jewelers' Saws

Many of the Screw Slotting Cutters listed are suitable for jewelers' use in sawing chain links and for similar work.

Ground Formed Cutters



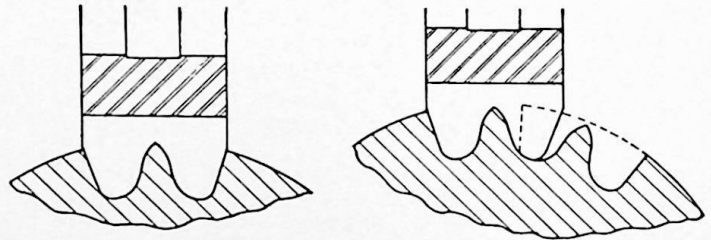
Ground Formed Cutters are desirable where a high degree of accuracy and uniformity is necessary. The grinding of the form eliminates slight errors and distortions unavoidably introduced in hardening. Also, as the teeth are ground evenly, no single tooth or small group of teeth can assume the major part of the work. Thus the teeth cut evenly, permitting the cutter to give the best production possible. This even distribution of work makes each cutter tooth wear more evenly, with resulting longer runs between sharpenings and longer cutter life.

The use of Ground Formed Cutters in cutting gears provides a positive control of form, permitting duplication of a high degree of accuracy in the finished gears.

We are fully equipped to furnish Ground Formed Cutters for gears, sprockets and spline shafts and for other uses where the size and form are within certain limitations, including multiple point thread cutters, rack cutters, and other cutters on which distances over a number of points must be held to small tolerances.



Straddle Sprocket Cutters



Complete tooth cut in one pass.



Type 1



Type 2

Only two cutters are required for complete range of teeth in any one pitch. One cutter cuts all sprockets having 17 teeth and under; other cutter cuts all sprockets having 18 teeth and over.

Regularly furnished with pitch line clearance, Type 1. Furnished also without pitch line clearance, Type 2.

For a high degree of tooth form accuracy, the single space type of cutter listed on page 37 is recommended.

When ordering, specify pitch, diameter of roll, range of teeth to be cut and type desired.

Sprocket Wheel Cutters for Roller Chains

American Standard Tooth Forms
Adopted by S.A.E., A.S.M.E., A.G.M.A.



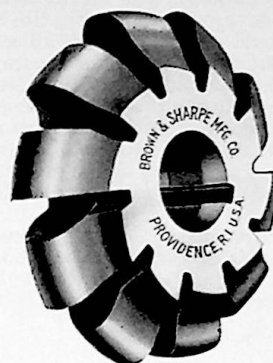
Type 1



Type 2

The cutters listed below have pitch line clearance Type 1.

Cutters, Type 2, without pitch line clearance can be furnished. When desired, Type 2 should be specified with complete catalog description.



Pitch, Inches	Diam. of Cutter, In.	Width of Cutter, In.	Hole, Inches	Diam. of Roll, In.	Range of Teeth in Sprocket	Order by Number	Old Catalog Number
3/8	2 3/4	1 5/32	1	.200	6	Order by Catalog Description	490-4
3/8	2 3/4	1 5/32	1	.200	7 to 8		490-8
3/8	2 3/4	1 5/32	1	.200	9 to 11		490-12
3/8	2 3/4	1 7/16	1	.200	12 to 17		490-16
3/8	2 3/4	1 7/16	1	.200	18 to 34		490-20
3/8	2 3/4	1 13/32	1	.200	35 and over		490-24
1/2 to 5/8	3	3/4	1	.313	6	Order by Catalog Description	490-28
1/2 to 5/8	3	3/4	1	.313	7 to 8		490-32
1/2 to 5/8	3 1/8	3/4	1	.313	9 to 11		705-490-36
1/2 to 5/8	3 1/8	3/4	1	.313	12 to 17		705-490-40
1/2 to 5/8	3 1/8	23/32	1	.313	18 to 34		705-490-44
1/2 to 5/8	3 1/8	1 1/16	1	.313	35 and over		705-490-48
5/8	3 1/8	3/4	1	.400	6	Order by Catalog Description	490-52
5/8	3 1/8	3/4	1	.400	7 to 8		490-56
5/8	3 1/4	3/4	1	.400	9 to 11		705-490-60
5/8	3 1/4	3/4	1	.400	12 to 17		705-490-64
5/8	3 1/4	23/32	1	.400	18 to 34		705-490-68
5/8	3 1/4	1 1/16	1	.400	35 and over		705-490-72
3/4	3 1/4	29/32	1	.469	6	Order by Catalog Description	490-76
3/4	3 1/4	29/32	1	.469	7 to 8		490-80
3/4	3 3/8	29/32	1	.469	9 to 11		705-490-84
3/4	3 3/8	7/8	1	.469	12 to 17		705-490-88
3/4	3 3/8	27/32	1	.469	18 to 34		705-490-92
3/4	3 3/8	1 1/16	1	.469	35 and over		705-490-96
1	3 3/4	1 1/4	1 1/4	.563	6	Order by Catalog Description	490-100
1	3 7/8	1 1/4	1 1/4	.563	7 to 8		490-104
1	3 7/8	1 3/16	1 1/4	.563	9 to 11		705-490-108
1	4	1 5/32	1 1/4	.563	12 to 17		705-490-112
1	4	1 1/8	1 1/4	.563	18 to 34		705-490-116
1	4	1 3/32	1 1/4	.563	35 and over		705-490-120
1 to 1 1/4	3 7/8	1 1/2	1 1/4	.625	6	Order by Catalog Description	490-124
1 to 1 1/4	4	1 1/2	1 1/4	.625	7 to 8		490-128
1 to 1 1/4	4 1/8	1 15/32	1 1/4	.625	9 to 11		705-490-132
1 to 1 1/4	4 1/8	1 15/32	1 1/4	.625	12 to 17		705-490-136
1 to 1 1/4	4 1/4	1 15/32	1 1/4	.625	18 to 34		705-490-140
1 to 1 1/4	4 1/4	1 15/32	1 1/4	.625	35 and over		705-490-144

Pitch, Inches	Diam. of Cutter, In.	Width of Cutter, In.	Hole, Inches	Diam. of Roll, In.	Range of Teeth in Sprocket	Order by Number	Old Catalog Number
1 1/4 to 1 1/2	4 1/4	1 13/16	1 1/4	.750	6	Order by Catalog Description	490-148
1 1/4 to 1 1/2	4 3/8	1 13/16	1 1/4	.750	7 to 8		490-152
1 1/4 to 1 1/2	4 1/2	1 25/32	1 1/4	.750	9 to 11		705-490-156
1 1/4 to 1 1/2	4 1/2	1 3/4	1 1/4	.750	12 to 17		705-490-160
1 1/4 to 1 1/2	4 5/8	1 11/16	1 1/4	.750	18 to 34		705-490-164
1 1/4 to 1 1/2	4 5/8	1 5/8	1 1/4	.750	35 and over		705-490-168
1 1/2	4 3/8	1 13/16	1 1/4	.875	6	Order by Catalog Description	490-172
1 1/2	4 1/2	1 13/16	1 1/4	.875	7 to 8		490-176
1 1/2	4 5/8	1 25/32	1 1/4	.875	9 to 11		490-180
1 1/2	4 5/8	1 3/4	1 1/4	.875	12 to 17		490-184
1 1/2	4 3/4	1 11/16	1 1/4	.875	18 to 34		490-188
1 1/2	4 3/4	1 5/8	1 1/4	.875	35 and over		490-192
1 3/4	5	2 3/32	1 1/2	1.000	6	Order by Catalog Description	490-196
1 3/4	5 1/8	2 3/32	1 1/2	1.000	7 to 8		490-200
1 3/4	5 1/4	2 1/16	1 1/2	1.000	9 to 11		490-204
1 3/4	5 3/8	2 1/32	1 1/2	1.000	12 to 17		490-208
1 3/4	5 1/2	1 31/32	1 1/2	1.000	18 to 34		490-212
1 3/4	5 1/2	1 7/8	1 1/2	1.000	35 and over		490-216
2	5 3/8	2 13/32	1 1/2	1.125	6	Order by Catalog Description	490-220
2	5 1/2	2 13/32	1 1/2	1.125	7 to 8		490-224
2	5 5/8	2 3/8	1 1/2	1.125	9 to 11		490-228
2	5 3/4	2 5/16	1 1/2	1.125	12 to 17		490-232
2	5 7/8	2 1/4	1 1/2	1.125	18 to 34		490-236
2	5 7/8	2 3/32	1 1/2	1.125	35 and over		490-240
2 1/2	6 3/8	3	1 3/4	1.563	6	Order by Catalog Description	490-244
2 1/2	6 5/8	3	1 3/4	1.563	7 to 8		490-248
2 1/2	6 3/4	2 15/16	1 3/4	1.563	9 to 11		490-252
2 1/2	6 7/8	2 29/32	1 3/4	1.563	12 to 17		490-256
2 1/2	7	2 3/4	1 3/4	1.563	18 to 34		490-260
2 1/2	7 1/8	2 1/16	1 3/4	1.563	35 and over		490-264
3	7 1/2	3 19/32	2	1.900	6	Order by Catalog Description	490-268
3	7 3/4	3 19/32	2	1.900	7 to 8		490-272
3	7 7/8	3 17/32	2	1.900	9 to 11		490-276
3	8	3 15/32	2	1.900	12 to 17		490-280
3	8	3 11/32	2	1.900	18 to 34		490-284
3	8 1/4	3 7/32	2	1.900	35 and over		490-288

Packed one in a box.

For Prices, See Separate Section

List of Keyways, page 32.

Sharpening Gear and Formed Cutters

Gear cutters and other formed cutters are sharpened by grinding the faces of the teeth. These faces are either radial or back of center, depending on the design of the cutters.

When properly sharpened, gear and formed cutters will produce duplicate work throughout their entire lives. In sharpening, the cutter should run true so that all teeth are the same height. The sharpened faces should be square with the sides of the cutters and they should be radial or back of center the proper amount according to the original design of the cutters.

A cutter made originally with radial faces always should be sharpened radially. A cutter with rake (faces back of center) should be sharpened according to the marking on the cutter, which specifies the amount of rake in either thousandths of an inch or degrees.

In sharpening cutters with rake when an unusually accurate form is required, it is necessary to change the angle of rake slightly from the original angle. Increase in angle of rake results in a greater depth of form while decrease in angle of

rake shortens form correspondingly. Thus, accurate duplication of form can be obtained merely by changing the angle of rake to compensate for the change in the form which otherwise would be caused by repeated sharpenings.

It is not economical to use cutters that are dull or partially dull. A sharp cutter stands up for a long period before becoming moderately dull in comparison to the moderately dull cutter which becomes excessively dull very quickly. When cutters become excessively dull a large amount of the cutter is ground away in restoring the cutting edge. For the most economical and efficient service, the time to sharpen a cutter is when it reaches the moderately dull stage, when only a small amount of grinding is required.

Correct and timely sharpening reduces power consumption, increases the number of parts produced during the life of the cutter, permits better finish, more accurately milled surfaces and longer cutter life.

To Set a Gear Cutter Central

An accurate method of setting a gear cutter central on a machine that has no cutter setting indicator, or when a very accurate gear is required, is to use a blank of the same size as the gear to be cut. If this is not convenient, a blank of a smaller size will do. After centering the cutter by eye take a single cut through the blank. Without changing the position of the cutter, remove the blank from the work arbor and turn it end for end. Leave the blank loose on the arbor and, with cutter stopped, feed the cutter into the slot already cut. Then run cutter just long enough to mark its position in relation to

the slot produced by the first cut.

If the cutter is exactly central, the second cut will follow the outline of the first. If out of center, the cutter will cut some stock from the top of the space on one side and from the bottom on the other side and the cutter or table should be moved laterally away from the side of the tooth from which stock was removed from the bottom. Repeat the above operation until the cutter is properly centered. If the first cut is colored with blue vitriol or red lead the position of the second cut will show very clearly.

Involute Spur Gear Cutters

Involute Spur Gear Cutters, based on a $14\frac{1}{2}^\circ$ pressure angle, are made with eight different forms (numbered 1 to 8) for each pitch depending upon the number of teeth for which the cutter is to be used. Ranges for the individual cutters are as follows:

No. of Cutter Form	Range, Teeth	No. of Cutter Form	Range, Teeth
1	135 to a rack	5	21 to 25
2	55 to 134	6	17 to 20
3	35 to 54	7	14 to 16
4	26 to 34	8	12 and 13

The above cutters are designed so that their forms are correct for the lowest number of teeth in each range. If, when cutting gears with a number of teeth near the higher end of the range, a more accurate tooth form is desired, we can furnish cutters to order in half numbers from one to eight pitch inclusive, with ranges as follows:

No. of Cutter Form	Range, Teeth	No. of Cutter Form	Range, Teeth
$1\frac{1}{2}$	80 to 134	$5\frac{1}{2}$	19 and 20
$2\frac{1}{2}$	42 to 54	$6\frac{1}{2}$	15 and 16
$3\frac{1}{2}$	30 to 34	$7\frac{1}{2}$	13
$4\frac{1}{2}$	23 to 25		

For a still greater degree of accuracy, cutters designed for the exact number of teeth can be furnished.

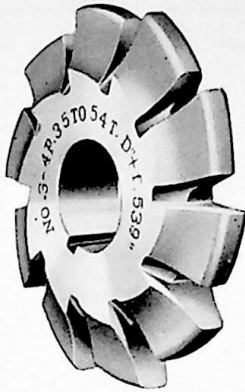
Because of the undercut which occurs in true involute gears of $14\frac{1}{2}^\circ$ pressure angle with a low number of teeth, involute gear cutters are designed to cut a composite tooth form, the center portion being true involute while the top and bottom are cycloidal. This eliminates the undercut and makes practical the cutting of gears by a rotary cutter at one pass of the cutter. Gears cut with involute gear cutters, therefore, will not interchange satisfactorily enough for high grade work with true involute gears.

In ordering stock gear cutters, give the diametral pitch, number and hole size.

In ordering special gear cutters, give the diametral pitch, pressure angle, hole size and number of teeth to be cut.

If cutters are desired for worm gears, give the number of teeth in gear, diameter of worm and number of threads per inch.

Involute Spur Gear Cutters



Involute Spur Gear Cutters (Cont'd)

Diametral Pitch	Diameter, Inches	Hole, Inches	No. of Cutter Form	Order by Number
1	8½	2		Made to order
1¼	7¾	2		Made to order
1½	7	1¾		Made to order
1¾	6½	1¾	1	705-530-1208
1¾	6½	1¾	2	705-530-2208
1¾	6½	1¾	3	705-530-3208
1¾	6½	1¾	4	705-530-4208
1¾	6½	1¾	5	705-530-5208
1¾	6½	1¾	6	705-530-6208
1¾	6½	1¾	7	705-530-7208
1¾	6½	1¾	8	705-530-8208
2	5¾	1½	1	705-530-1210
2	5¾	1½	2	705-530-2210
2	5¾	1½	3	705-530-3210
2	5¾	1½	4	705-530-4210
2	5¾	1½	5	705-530-5210
2	5¾	1½	6	705-530-6210
2	5¾	1½	7	705-530-7210
2	5¾	1½	8	705-530-8210
2½	5¾	1½	1	705-530-1212
2½	5¾	1½	2	705-530-2212
2½	5¾	1½	3	705-530-3212
2½	5¾	1½	4	705-530-4212
2½	5¾	1½	5	705-530-5212
2½	5¾	1½	6	705-530-6212
2½	5¾	1½	7	705-530-7212
2½	5¾	1½	8	705-530-8212
3	4¾	1¼	1	705-530-1214
3	4¾	1¼	2	705-530-2214
3	4¾	1¼	3	705-530-3214
3	4¾	1¼	4	705-530-4214
3	4¾	1¼	5	705-530-5214
3	4¾	1¼	6	705-530-6214
3	4¾	1¼	7	705-530-7214
3	4¾	1¼	8	705-530-8214
4	4¼	1¼	1	705-530-1216
4	4¼	1¼	2	705-530-2216
4	4¼	1¼	3	705-530-3216
4	4¼	1¼	4	705-530-4216
4	4¼	1¼	5	705-530-5216
4	4¼	1¼	6	705-530-6216
4	4¼	1¼	7	705-530-7216
4	4¼	1¼	8	705-530-8216
5	3¾	1¼	1	705-530-1218

Diametral Pitch	Diameter, Inches	Hole, Inches	No. of Cutter Form	Order by Number
5	3¾	1¼	2	705-530-2218
5	3¾	1¼	3	705-530-3218
5	3¾	1¼	4	705-530-4218
5	3¾	1¼	5	705-530-5218
5	3¾	1¼	6	705-530-6218
5	3¾	1¼	7	705-530-7218
5	3¾	1¼	8	705-530-8218
6	3⅛	1	1	705-530-1220
6	3⅛	1	2	705-530-2220
6	3⅛	1	3	705-530-3220
6	3⅛	1	4	705-530-4220
6	3⅛	1	5	705-530-5220
6	3⅛	1	6	705-530-6220
6	3⅛	1	7	705-530-7220
6	3⅛	1	8	705-530-8220
7	2⅞	1	1	705-530-1222
7	2⅞	1	2	705-530-2222
7	2⅞	1	3	705-530-3222
7	2⅞	1	4	705-530-4222
7	2⅞	1	5	705-530-5222
7	2⅞	1	6	705-530-6222
7	2⅞	1	7	705-530-7222
7	2⅞	1	8	705-530-8222
8	2⅞	1	1	705-530-1224
8	2⅞	1	2	705-530-2224
8	2⅞	1	3	705-530-3224
8	2⅞	1	4	705-530-4224
8	2⅞	1	5	705-530-5224
8	2⅞	1	6	705-530-6224
8	2⅞	1	7	705-530-7224
8	2⅞	1	8	705-530-8224
9	2¾	1	1	705-530-1226
9	2¾	1	2	705-530-2226
9	2¾	1	3	705-530-3226
9	2¾	1	4	705-530-4226
9	2¾	1	5	705-530-5226
9	2¾	1	6	705-530-6226
9	2¾	1	7	705-530-7226
9	2¾	1	8	705-530-8226
10	2⅝	⅞	1	705-530-1228
10	2⅝	⅞	2	705-530-2228
10	2⅝	⅞	3	705-530-3228
10	2⅝	⅞	4	705-530-4228
10	2⅝	⅞	5	705-530-5228
10	2⅝	⅞	6	705-530-6228
10	2⅝	⅞	7	705-530-7228
10	2⅝	⅞	8	705-530-8228
11	2⅝	⅞	1	705-530-1230
11	2⅝	⅞	2	705-530-2230
11	2⅝	⅞	3	705-530-3230
11	2⅝	⅞	4	705-530-4230
11	2⅝	⅞	5	705-530-5230
11	2⅝	⅞	6	705-530-6230
11	2⅝	⅞	7	705-530-7230
11	2⅝	⅞	8	705-530-8230
12	2¼	⅞	1	705-530-1232
12	2¼	⅞	2	705-530-2232
12	2¼	⅞	3	705-530-3232
12	2¼	⅞	4	705-530-4232
12	2¼	⅞	5	705-530-5232
12	2¼	⅞	6	705-530-6232
12	2¼	⅞	7	705-530-7232
12	2¼	⅞	8	705-530-8232
14	2⅜	⅞	1	705-530-1234
14	2⅜	⅞	2	705-530-2234

Each of the above packed one in a box.

Involute Spur Gear Cutters (Cont'd)

Diametral Pitch	Diameter, Inches	Hole, Inches	No. of Cutter Form	Order by Number
14	2 1/8	7/8	3	705-530-3234
14	2 1/8	7/8	4	705-530-4234
14	2 1/8	7/8	5	705-530-5234
14	2 1/8	7/8	6	705-530-6234
14	2 1/8	7/8	7	705-530-7234
14	2 1/8	7/8	8	705-530-8234
16	2 1/8	7/8	1	705-530-1236
16	2 1/8	7/8	2	705-530-2236
16	2 1/8	7/8	3	705-530-3236
16	2 1/8	7/8	4	705-530-4236
16	2 1/8	7/8	5	705-530-5236
16	2 1/8	7/8	6	705-530-6236
16	2 1/8	7/8	7	705-530-7236
16	2 1/8	7/8	8	705-530-8236
18	2	7/8	1	705-530-1238
18	2	7/8	2	705-530-2238
18	2	7/8	3	705-530-3238
18	2	7/8	4	705-530-4238
18	2	7/8	5	705-530-5238
18	2	7/8	6	705-530-6238
18	2	7/8	7	705-530-7238
18	2	7/8	8	705-530-8238
20	2	7/8	1	705-530-1240
20	2	7/8	2	705-530-2240
20	2	7/8	3	705-530-3240
20	2	7/8	4	705-530-4240
20	2	7/8	5	705-530-5240
20	2	7/8	6	705-530-6240
20	2	7/8	7	705-530-7240
20	2	7/8	8	705-530-8240
22	2	7/8	1	705-530-1242
22	2	7/8	2	705-530-2242
22	2	7/8	3	705-530-3242
22	2	7/8	4	705-530-4242
22	2	7/8	5	705-530-5242
22	2	7/8	6	705-530-6242
22	2	7/8	7	705-530-7242
22	2	7/8	8	705-530-8242
24	1 3/4	7/8	1	705-530-1244
24	1 3/4	7/8	2	705-530-2244
24	1 3/4	7/8	3	705-530-3244
24	1 3/4	7/8	4	705-530-4244
24	1 3/4	7/8	5	705-530-5244
24	1 3/4	7/8	6	705-530-6244
24	1 3/4	7/8	7	705-530-7244
24	1 3/4	7/8	8	705-530-8244
26	1 3/4	7/8	1	705-530-1246
26	1 3/4	7/8	2	705-530-2246
26	1 3/4	7/8	3	705-530-3246
26	1 3/4	7/8	4	705-530-4246
26	1 3/4	7/8	5	705-530-5246
26	1 3/4	7/8	6	705-530-6246
26	1 3/4	7/8	7	705-530-7246
26	1 3/4	7/8	8	705-530-8246
28	1 3/4	7/8	1	705-530-1248
28	1 3/4	7/8	2	705-530-2248
28	1 3/4	7/8	3	705-530-3248
28	1 3/4	7/8	4	705-530-4248
28	1 3/4	7/8	5	705-530-5248
28	1 3/4	7/8	6	705-530-6248
28	1 3/4	7/8	7	705-530-7248
28	1 3/4	7/8	8	705-530-8248
30	1 3/4	7/8	1	705-530-1250
30	1 3/4	7/8	2	705-530-2250
30	1 3/4	7/8	3	705-530-3250

Involute Spur Gear Cutters (Cont'd)

Diametral Pitch	Diameter, Inches	Hole, Inches	No. of Cutter Form	Order by Number
30	1 3/4	7/8	4	705-530-4250
30	1 3/4	7/8	5	705-530-5250
30	1 3/4	7/8	6	705-530-6250
30	1 3/4	7/8	7	705-530-7250
30	1 3/4	7/8	8	705-530-8250
32	1 3/4	7/8	1	705-530-1252
32	1 3/4	7/8	2	705-530-2252
32	1 3/4	7/8	3	705-530-3252
32	1 3/4	7/8	4	705-530-4252
32	1 3/4	7/8	5	705-530-5252
32	1 3/4	7/8	6	705-530-6252
32	1 3/4	7/8	7	705-530-7252
32	1 3/4	7/8	8	705-530-8252
36	1 3/4	7/8	1	705-530-1254
36	1 3/4	7/8	2	705-530-2254
36	1 3/4	7/8	3	705-530-3254
36	1 3/4	7/8	4	705-530-4254
36	1 3/4	7/8	5	705-530-5254
36	1 3/4	7/8	6	705-530-6254
36	1 3/4	7/8	7	705-530-7254
36	1 3/4	7/8	8	705-530-8254
40	1 3/4	7/8	1	705-530-1256
40	1 3/4	7/8	2	705-530-2256
40	1 3/4	7/8	3	705-530-3256
40	1 3/4	7/8	4	705-530-4256
40	1 3/4	7/8	5	705-530-5256
40	1 3/4	7/8	6	705-530-6256
40	1 3/4	7/8	7	705-530-7256
40	1 3/4	7/8	8	705-530-8256
48	1 3/4	7/8	1	705-530-1258
48	1 3/4	7/8	2	705-530-2258
48	1 3/4	7/8	3	705-530-3258
48	1 3/4	7/8	4	705-530-4258
48	1 3/4	7/8	5	705-530-5258
48	1 3/4	7/8	6	705-530-6258
48	1 3/4	7/8	7	705-530-7258
48	1 3/4	7/8	8	705-530-8258

Involute Spur Gear Cutters

For Use on Brown & Sharpe
No. 3 Automatic Gear Cutting Machine

Diametral Pitch	Diameter, Inches	Hole, Inches	No. of Cutter Form	Order by Number
4	3 5/8	1	1	705-530-1302
4	3 5/8	1	2	705-530-2302
4	3 5/8	1	3	705-530-3302
4	3 5/8	1	4	705-530-4302
4	3 5/8	1	5	705-530-5302
4	3 5/8	1	6	705-530-6302
4	3 5/8	1	7	705-530-7302
4	3 5/8	1	8	705-530-8302
5	3 3/8	1	1	705-530-1304
5	3 3/8	1	2	705-530-2304
5	3 3/8	1	3	705-530-3304
5	3 3/8	1	4	705-530-4304
5	3 3/8	1	5	705-530-5304
5	3 3/8	1	6	705-530-6304
5	3 3/8	1	7	705-530-7304
5	3 3/8	1	8	705-530-8304
6	3 1/8	1	1	705-530-1220

Metric Involute Spur Gear Cutters for use on Machine above
can be furnished to order.

Each of the above packed one in a box.

For Prices, See Separate Section

List of Keyways, page 32.

Involute Spur Gear Cutters (Cont'd)

For Use on Brown & Sharpe
No. 3 Automatic Gear Cutting Machine

Diametral Pitch	Diameter, Inches	Hole, Inches	No. of Cutter Form	Order by Number
6	3 1/8	1	2	705-530-2220
6	3 1/8	1	3	705-530-3220
6	3 1/8	1	4	705-530-4220
6	3 1/8	1	5	705-530-5220
6	3 1/8	1	6	705-530-6220
6	3 1/8	1	7	705-530-7220
6	3 1/8	1	8	705-530-8220
7	2 7/8	1	1	705-530-1222
7	2 7/8	1	2	705-530-2222
7	2 7/8	1	3	705-530-3222
7	2 7/8	1	4	705-530-4222
7	2 7/8	1	5	705-530-5222
7	2 7/8	1	6	705-530-6222
7	2 7/8	1	7	705-530-7222
7	2 7/8	1	8	705-530-8222
8	2 7/8	1	1	705-530-1224
8	2 7/8	1	2	705-530-2224
8	2 7/8	1	3	705-530-3224
8	2 7/8	1	4	705-530-4224
8	2 7/8	1	5	705-530-5224
8	2 7/8	1	6	705-530-6224
8	2 7/8	1	7	705-530-7224
8	2 7/8	1	8	705-530-8224
9	2 3/4	1	1	705-530-1226
9	2 3/4	1	2	705-530-2226
9	2 3/4	1	3	705-530-3226
9	2 3/4	1	4	705-530-4226
9	2 3/4	1	5	705-530-5226
9	2 3/4	1	6	705-530-6226
9	2 3/4	1	7	705-530-7226
9	2 3/4	1	8	705-530-8226
10	2 3/4	1	1	705-530-1306
10	2 3/4	1	2	705-530-2306
10	2 3/4	1	3	705-530-3306
10	2 3/4	1	4	705-530-4306
10	2 3/4	1	5	705-530-5306
10	2 3/4	1	6	705-530-6306
10	2 3/4	1	7	705-530-7306
10	2 3/4	1	8	705-530-8306
11	2 5/8	1	1	705-530-1308
11	2 5/8	1	2	705-530-2308
11	2 5/8	1	3	705-530-3308
11	2 5/8	1	4	705-530-4308
11	2 5/8	1	5	705-530-5308
11	2 5/8	1	6	705-530-6308
11	2 5/8	1	7	705-530-7308
11	2 5/8	1	8	705-530-8308
12	2 5/8	1	1	705-530-1310
12	2 5/8	1	2	705-530-2310
12	2 5/8	1	3	705-530-3310
12	2 5/8	1	4	705-530-4310
12	2 5/8	1	5	705-530-5310
12	2 5/8	1	6	705-530-6310
12	2 5/8	1	7	705-530-7310
12	2 5/8	1	8	705-530-8310
14	2 1/2	1	1	705-530-1312
14	2 1/2	1	2	705-530-2312
14	2 1/2	1	3	705-530-3312
14	2 1/2	1	4	705-530-4312
14	2 1/2	1	5	705-530-5312
14	2 1/2	1	6	705-530-6312
14	2 1/2	1	7	705-530-7312

Involute Spur Gear Cutters (Cont'd)

For Use on Brown & Sharpe
No. 3 Automatic Gear Cutting Machine

Diametral Pitch	Diameter, Inches	Hole, Inches	No. of Cutter Form	Order by Number
14	2 1/2	1	8	705-530-8312
16	2 1/2	1	1	705-530-1314
16	2 1/2	1	2	705-530-2314
16	2 1/2	1	3	705-530-3314
16	2 1/2	1	4	705-530-4314
16	2 1/2	1	5	705-530-5314
16	2 1/2	1	6	705-530-6314
16	2 1/2	1	7	705-530-7314
16	2 1/2	1	8	705-530-8314
18	2 3/8	1	1	705-530-1316
18	2 3/8	1	2	705-530-2316
18	2 3/8	1	3	705-530-3316
18	2 3/8	1	4	705-530-4316
18	2 3/8	1	5	705-530-5316
18	2 3/8	1	6	705-530-6316
18	2 3/8	1	7	705-530-7316
18	2 3/8	1	8	705-530-8316
20	2 3/8	1	1	705-530-1318
20	2 3/8	1	2	705-530-2318
20	2 3/8	1	3	705-530-3318
20	2 3/8	1	4	705-530-4318
20	2 3/8	1	5	705-530-5318
20	2 3/8	1	6	705-530-6318
20	2 3/8	1	7	705-530-7318
20	2 3/8	1	8	705-530-8318
22	2 1/4	1	1	705-530-1320
22	2 1/4	1	2	705-530-2320
22	2 1/4	1	3	705-530-3320
22	2 1/4	1	4	705-530-4320
22	2 1/4	1	5	705-530-5320
22	2 1/4	1	6	705-530-6320
22	2 1/4	1	7	705-530-7320
22	2 1/4	1	8	705-530-8320
24	2 1/4	1	1	705-530-1322
24	2 1/4	1	2	705-530-2322
24	2 1/4	1	3	705-530-3322
24	2 1/4	1	4	705-530-4322
24	2 1/4	1	5	705-530-5322
24	2 1/4	1	6	705-530-6322
24	2 1/4	1	7	705-530-7322
24	2 1/4	1	8	705-530-8322

Involute Spur Gear Cutters

For Use on Brown & Sharpe
Nos. 4 and 13H Automatic Gear Cutting Machines

Diametral Pitch	Diameter, Inches	Hole, Inches	No. of Cutter Form	Order by Number
3	4 3/4	1 1/4	1	705-530-1214
3	4 3/4	1 1/4	2	705-530-2214
3	4 3/4	1 1/4	3	705-530-3214
3	4 3/4	1 1/4	4	705-530-4214
3	4 3/4	1 1/4	5	705-530-5214
3	4 3/4	1 1/4	6	705-530-6214
3	4 3/4	1 1/4	7	705-530-7214
3	4 3/4	1 1/4	8	705-530-8214
4	4 1/4	1 1/4	1	705-530-1216
4	4 1/4	1 1/4	2	705-530-2216
4	4 1/4	1 1/4	3	705-530-3216
4	4 1/4	1 1/4	4	705-530-4216

Metric Involute Spur Gear Cutters for use on Machines above can be furnished to order.
Each of the above packed one in a box.

Involute Spur Gear Cutters (Cont'd)

For Use on Brown & Sharpe
Nos. 4 and 13H Automatic Gear Cutting Machines

Diametral Pitch	Diameter, Inches	Hole, Inches	No. of Cutter Form	Order by Number
4	4 1/4	1 1/4	5	705-530-5216
4	4 1/4	1 1/4	6	705-530-6216
4	4 1/4	1 1/4	7	705-530-7216
4	4 1/4	1 1/4	8	705-530-8216
5	3 3/4	1 1/4	1	705-530-1218
5	3 3/4	1 1/4	2	705-530-2218
5	3 3/4	1 1/4	3	705-530-3218
5	3 3/4	1 1/4	4	705-530-4218
5	3 3/4	1 1/4	5	705-530-5218
5	3 3/4	1 1/4	6	705-530-6218
5	3 3/4	1 1/4	7	705-530-7218
5	3 3/4	1 1/4	8	705-530-8218
6	3 1/2	1 1/4	1	705-530-1402
6	3 1/2	1 1/4	2	705-530-2402
6	3 1/2	1 1/4	3	705-530-3402
6	3 1/2	1 1/4	4	705-530-4402
6	3 1/2	1 1/4	5	705-530-5402
6	3 1/2	1 1/4	6	705-530-6402
6	3 1/2	1 1/4	7	705-530-7402
6	3 1/2	1 1/4	8	705-530-8402
7	3 3/8	1 1/4	1	705-530-1404
7	3 3/8	1 1/4	2	705-530-2404
7	3 3/8	1 1/4	3	705-530-3404
7	3 3/8	1 1/4	4	705-530-4404
7	3 3/8	1 1/4	5	705-530-5404
7	3 3/8	1 1/4	6	705-530-6404
7	3 3/8	1 1/4	7	705-530-7404
7	3 3/8	1 1/4	8	705-530-8404
8	3 1/4	1 1/4	1	705-530-1406
8	3 1/4	1 1/4	2	705-530-2406
8	3 1/4	1 1/4	3	705-530-3406
8	3 1/4	1 1/4	4	705-530-4406
8	3 1/4	1 1/4	5	705-530-5406
8	3 1/4	1 1/4	6	705-530-6406
8	3 1/4	1 1/4	7	705-530-7406
8	3 1/4	1 1/4	8	705-530-8406
9	3 1/8	1 1/4	1	705-530-1408
9	3 1/8	1 1/4	2	705-530-2408
9	3 1/8	1 1/4	3	705-530-3408
9	3 1/8	1 1/4	4	705-530-4408
9	3 1/8	1 1/4	5	705-530-5408
9	3 1/8	1 1/4	6	705-530-6408
9	3 1/8	1 1/4	7	705-530-7408
9	3 1/8	1 1/4	8	705-530-8408
10	3	1 1/4	1	705-530-1410
10	3	1 1/4	2	705-530-2410
10	3	1 1/4	3	705-530-3410
10	3	1 1/4	4	705-530-4410
10	3	1 1/4	5	705-530-5410
10	3	1 1/4	6	705-530-6410
10	3	1 1/4	7	705-530-7410
10	3	1 1/4	8	705-530-8410
12	2 7/8	1 1/4	1	705-530-1412
12	2 7/8	1 1/4	2	705-530-2412
12	2 7/8	1 1/4	3	705-530-3412
12	2 7/8	1 1/4	4	705-530-4412
12	2 7/8	1 1/4	5	705-530-5412
12	2 7/8	1 1/4	6	705-530-6412
12	2 7/8	1 1/4	7	705-530-7412
12	2 7/8	1 1/4	8	705-530-8412

Metric Involute Gear Cutters for use on Machines above can be furnished to order.

Packed one in a box.

For Prices, See Separate Section

Involute Spur Gear Cutters

For Use on Brown & Sharpe
No. 5 Automatic Gear Cutting Machine

Diametral Pitch	Diameter, Inches	Hole, Inches	No. of Cutter Form	Order by Number
2	5 3/4	1 1/2	1	705-530-1210
2	5 3/4	1 1/2	2	705-530-2210
2	5 3/4	1 1/2	3	705-530-3210
2	5 3/4	1 1/2	4	705-530-4210
2	5 3/4	1 1/2	5	705-530-5210
2	5 3/4	1 1/2	6	705-530-6210
2	5 3/4	1 1/2	7	705-530-7210
2	5 3/4	1 1/2	8	705-530-8210
2 1/2	5 3/4	1 1/2	1	705-530-1212
2 1/2	5 3/4	1 1/2	2	705-530-2212
2 1/2	5 3/4	1 1/2	3	705-530-3212
2 1/2	5 3/4	1 1/2	4	705-530-4212
2 1/2	5 3/4	1 1/2	5	705-530-5212
2 1/2	5 3/4	1 1/2	6	705-530-6212
2 1/2	5 3/4	1 1/2	7	705-530-7212
2 1/2	5 3/4	1 1/2	8	705-530-8212
3	5 1/4	1 1/2	1	705-530-1502
3	5 1/4	1 1/2	2	705-530-2502
3	5 1/4	1 1/2	3	705-530-3502
3	5 1/4	1 1/2	4	705-530-4502
3	5 1/4	1 1/2	5	705-530-5502
3	5 1/4	1 1/2	6	705-530-6502
3	5 1/4	1 1/2	7	705-530-7502
3	5 1/4	1 1/2	8	705-530-8502
4	4 1/2	1 1/2	1	705-530-1504
4	4 1/2	1 1/2	2	705-530-2504
4	4 1/2	1 1/2	3	705-530-3504
4	4 1/2	1 1/2	4	705-530-4504
4	4 1/2	1 1/2	5	705-530-5504
4	4 1/2	1 1/2	6	705-530-6504
4	4 1/2	1 1/2	7	705-530-7504
4	4 1/2	1 1/2	8	705-530-8504
5	4 1/4	1 1/2	1	705-530-1506
5	4 1/4	1 1/2	2	705-530-2506
5	4 1/4	1 1/2	3	705-530-3506
5	4 1/4	1 1/2	4	705-530-4506
5	4 1/4	1 1/2	5	705-530-5506
5	4 1/4	1 1/2	6	705-530-6506
5	4 1/4	1 1/2	7	705-530-7506
5	4 1/4	1 1/2	8	705-530-8506
6	3 7/8	1 1/2	1	705-530-1508
6	3 7/8	1 1/2	2	705-530-2508
6	3 7/8	1 1/2	3	705-530-3508
6	3 7/8	1 1/2	4	705-530-4508
6	3 7/8	1 1/2	5	705-530-5508
6	3 7/8	1 1/2	6	705-530-6508
6	3 7/8	1 1/2	7	705-530-7508
6	3 7/8	1 1/2	8	705-530-8508

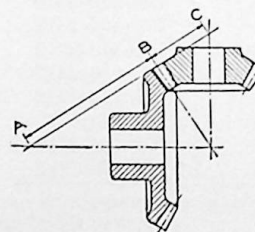
Packed one in a box.

Metric Involute Gear Cutters can be furnished to order.

Cutters for Mitre and Bevel Gears

These cutters are thin enough to cut any bevel gear whose tooth face is not longer than one third the distance from its outer end to the point where the shaft center lines meet.

To select Number of Cutter Form for cutters for mitre and bevel gears with axes at any angle, double the back cone radius AB (for the gear) or BC (for the pinion) and multiply by the diametral pitch. This gives number of teeth in an equivalent spur gear and by reference to page 38 the proper Cutter Form Number can be selected.



List of Keyways, page 32.

Cutters for Mitre and Bevel Gears

**Cutters for Mitre and Bevel Gears
(Cont'd)**

Diametral Pitch	Diameter, Inches	Hole, Inches	No. of Cutter Form	Order by Number
3	4	1 1/4	1	705-570-1602
3	4	1 1/4	2	705-570-2602
3	4	1 1/4	3	705-570-3602
3	4	1 1/4	4	705-570-4602
3	4	1 1/4	5	705-570-5602
3	4	1 1/4	6	705-570-6602
3	4	1 1/4	7	705-570-7602
3	4	1 1/4	8	705-570-8602
4	3 5/8	1 1/4	1	705-570-1604
4	3 5/8	1 1/4	2	705-570-2604
4	3 5/8	1 1/4	3	705-570-3604
4	3 5/8	1 1/4	4	705-570-4604
4	3 5/8	1 1/4	5	705-570-5604
4	3 5/8	1 1/4	6	705-570-6604
4	3 5/8	1 1/4	7	705-570-7604
4	3 5/8	1 1/4	8	705-570-8604
5	3 3/8	1 1/4	1	705-570-1606
5	3 3/8	1 1/4	2	705-570-2606
5	3 3/8	1 1/4	3	705-570-3606
5	3 3/8	1 1/4	4	705-570-4606
5	3 3/8	1 1/4	5	705-570-5606
5	3 3/8	1 1/4	6	705-570-6606
5	3 3/8	1 1/4	7	705-570-7606
5	3 3/8	1 1/4	8	705-570-8606
6	3 1/8	1	1	705-570-1608
6	3 1/8	1	2	705-570-2608
6	3 1/8	1	3	705-570-3608
6	3 1/8	1	4	705-570-4608
6	3 1/8	1	5	705-570-5608
6	3 1/8	1	6	705-570-6608
6	3 1/8	1	7	705-570-7608
6	3 1/8	1	8	705-570-8608
7	2 7/8	1	1	705-570-1610
7	2 7/8	1	2	705-570-2610
7	2 7/8	1	3	705-570-3610
7	2 7/8	1	4	705-570-4610
7	2 7/8	1	5	705-570-5610
7	2 7/8	1	6	705-570-6610
7	2 7/8	1	7	705-570-7610
7	2 7/8	1	8	705-570-8610
8	2 7/8	1	1	705-570-1612
8	2 7/8	1	2	705-570-2612
8	2 7/8	1	3	705-570-3612
8	2 7/8	1	4	705-570-4612
8	2 7/8	1	5	705-570-5612
8	2 7/8	1	6	705-570-6612
8	2 7/8	1	7	705-570-7612
8	2 7/8	1	8	705-570-8612
10	2 3/8	7/8	1	705-570-1614
10	2 3/8	7/8	2	705-570-2614
10	2 3/8	7/8	3	705-570-3614
10	2 3/8	7/8	4	705-570-4614
10	2 3/8	7/8	5	705-570-5614
10	2 3/8	7/8	6	705-570-6614
10	2 3/8	7/8	7	705-570-7614
10	2 3/8	7/8	8	705-570-8614
12	2 1/4	7/8	1	705-570-1616
12	2 1/4	7/8	2	705-570-2616
12	2 1/4	7/8	3	705-570-3616
12	2 1/4	7/8	4	705-570-4616
12	2 1/4	7/8	5	705-570-5616
12	2 1/4	7/8	6	705-570-6616

Diametral Pitch	Diameter, Inches	Hole, Inches	No. of Cutter Form	Order by Number
12	2 1/4	7/8	7	705-570-7616
12	2 1/4	7/8	8	705-570-8616
14	2 1/8	7/8	1	705-570-1618
14	2 1/8	7/8	2	705-570-2618
14	2 1/8	7/8	3	705-570-3618
14	2 1/8	7/8	4	705-570-4618
14	2 1/8	7/8	5	705-570-5618
14	2 1/8	7/8	6	705-570-6618
14	2 1/8	7/8	7	705-570-7618
14	2 1/8	7/8	8	705-570-8618
16	2 1/8	7/8	1	705-570-1620
16	2 1/8	7/8	2	705-570-2620
16	2 1/8	7/8	3	705-570-3620
16	2 1/8	7/8	4	705-570-4620
16	2 1/8	7/8	5	705-570-5620
16	2 1/8	7/8	6	705-570-6620
16	2 1/8	7/8	7	705-570-7620
16	2 1/8	7/8	8	705-570-8620
20	2	7/8	1	705-570-1622
20	2	7/8	2	705-570-2622
20	2	7/8	3	705-570-3622
20	2	7/8	4	705-570-4622
20	2	7/8	5	705-570-5622
20	2	7/8	6	705-570-6622
20	2	7/8	7	705-570-7622
20	2	7/8	8	705-570-8622
24	1 3/4	7/8	1	705-570-1624
24	1 3/4	7/8	2	705-570-2624
24	1 3/4	7/8	3	705-570-3624
24	1 3/4	7/8	4	705-570-4624
24	1 3/4	7/8	5	705-570-5624
24	1 3/4	7/8	6	705-570-6624
24	1 3/4	7/8	7	705-570-7624
24	1 3/4	7/8	8	705-570-8624

Metric Involute Spur Gear Cutters

Cutters for cutting the teeth of gears according to the Metric system can be furnished.

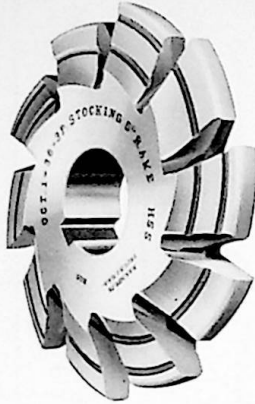
In ordering, specify Module of cutter and No. of cutter form, see page 38.

Module, Mm.	Diameter, Inches	Hole	Module, Mm.	Diameter, Inches	Hole
1/2	1 3/4	7/8" or 22 mm.	4 1/4	3 1/8	1" or 27 mm.
3/4	1 3/4	7/8 or 22	4 1/2	3 3/4	1 1/4 or 32
1	1 3/4	7/8 or 22	4 3/4	3 3/4	1 1/4 or 32
1 1/4	2	7/8 or 22	5	3 3/4	1 1/4 or 32
1 1/2	2 1/8	7/8 or 22	5 1/4	3 3/4	1 1/4 or 32
1 3/4	2 1/8	7/8 or 22	5 1/2	4	1 1/4 or 32
2	2 1/4	7/8 or 22	5 3/4	4	1 1/4 or 32
2 1/4	2 3/8	7/8 or 22	6	4 1/4	1 1/4 or 32
2 1/2	2 3/8	7/8 or 22	7	4 1/2	1 1/4 or 32
2 3/4	2 3/4	1 or 27	8	4 3/4	1 1/4 or 32
3	2 7/8	1 or 27	9	5 1/2	1 1/2 or 40
3 1/4	2 7/8	1 or 27	10	5 3/4	1 1/2 or 40
3 1/2	2 7/8	1 or 27	11	5 3/4	1 1/2 or 40
3 3/4	2 7/8	1 or 27	12	5 3/4	1 1/2 or 40
4	3 1/8	1 or 27			

Each of the above packed one in a box.

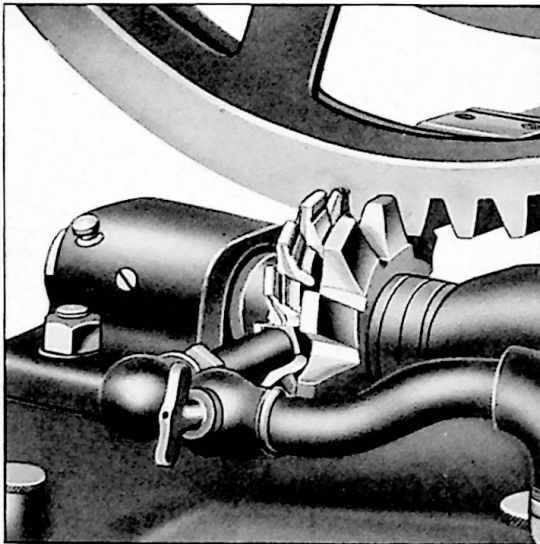
Stocking Cutters for Involute Spur Gears

With Undercut Teeth



The chip breaking action of the grooved teeth of these Stocking Cutters allows heavy cuts to be taken at fast speeds and feeds. The grooves are staggered from tooth to tooth so that the profile produced is smooth, permitting a maximum amount of stock to be removed in readiness for the finishing cut. The staggered grooves also distribute the wear on the cutter over its entire form.

Because of the easy cutting action and evenly distributed wear, the life of the cutter is increased and the power consumed by the machine is kept at a minimum.



While often used singly to advantage, stocking cutters also can be used many times in combination with a finishing cutter, so that the stocking cutter is roughing out while the finishing cutter is finishing. Many makers of gears find good economy in this "double cutter" method for certain types of work.

For Prices. See Separate Section

Stocking Cutters for Involute Spur Gears

With Undercut Teeth

Diametral Pitch	Diameter, Inches	Hole, Inches	Order by Number
1	8 $\frac{1}{2}$	2	Order by Catalog Description 705-610-270 705-610-272 705-610-274 705-610-276 705-610-278 705-610-280 705-610-282 705-610-284 705-610-286
1 $\frac{1}{4}$	7 $\frac{3}{4}$	2	
1 $\frac{1}{2}$	7	1 $\frac{3}{4}$	
1 $\frac{3}{4}$	6 $\frac{1}{2}$	1 $\frac{3}{4}$	
2	5 $\frac{3}{4}$	1 $\frac{1}{2}$	
2 $\frac{1}{2}$	5 $\frac{3}{4}$	1 $\frac{1}{2}$	
3	4 $\frac{3}{4}$	1 $\frac{1}{4}$	
4	4 $\frac{1}{4}$	1 $\frac{1}{4}$	
5	3 $\frac{3}{4}$	1 $\frac{1}{4}$	
6	3 $\frac{1}{8}$	1	
7	2 $\frac{7}{8}$	1	
8	2 $\frac{7}{8}$	1	

Stocking Cutters for Involute Spur Gears

With Undercut Teeth

For Use on Brown & Sharpe
No. 3 Automatic Gear Cutting Machine

Diametral Pitch	Diameter, Inches	Hole, Inches	Order by Number
4	3 $\frac{5}{8}$	1	705-610-370
5	3 $\frac{3}{8}$	1	705-610-372
6	3 $\frac{1}{8}$	1	705-610-282
7	2 $\frac{7}{8}$	1	705-610-284
8	2 $\frac{7}{8}$	1	705-610-286

Stocking Cutters for Involute Spur Gears

With Undercut Teeth

For Use on Brown & Sharpe
Nos. 4 and 13H Automatic Gear Cutting Machines

Diametral Pitch	Diameter, Inches	Hole, Inches	Order by Number
3	4 $\frac{3}{4}$	1 $\frac{1}{4}$	705-610-276
4	4 $\frac{1}{4}$	1 $\frac{1}{4}$	705-610-278
5	3 $\frac{3}{4}$	1 $\frac{1}{4}$	705-610-280
6	3 $\frac{1}{2}$	1 $\frac{1}{4}$	705-610-470
7	3 $\frac{3}{8}$	1 $\frac{1}{4}$	705-610-472
8	3 $\frac{1}{4}$	1 $\frac{1}{4}$	705-610-478

Stocking Cutters for Involute Spur Gears

With Undercut Teeth

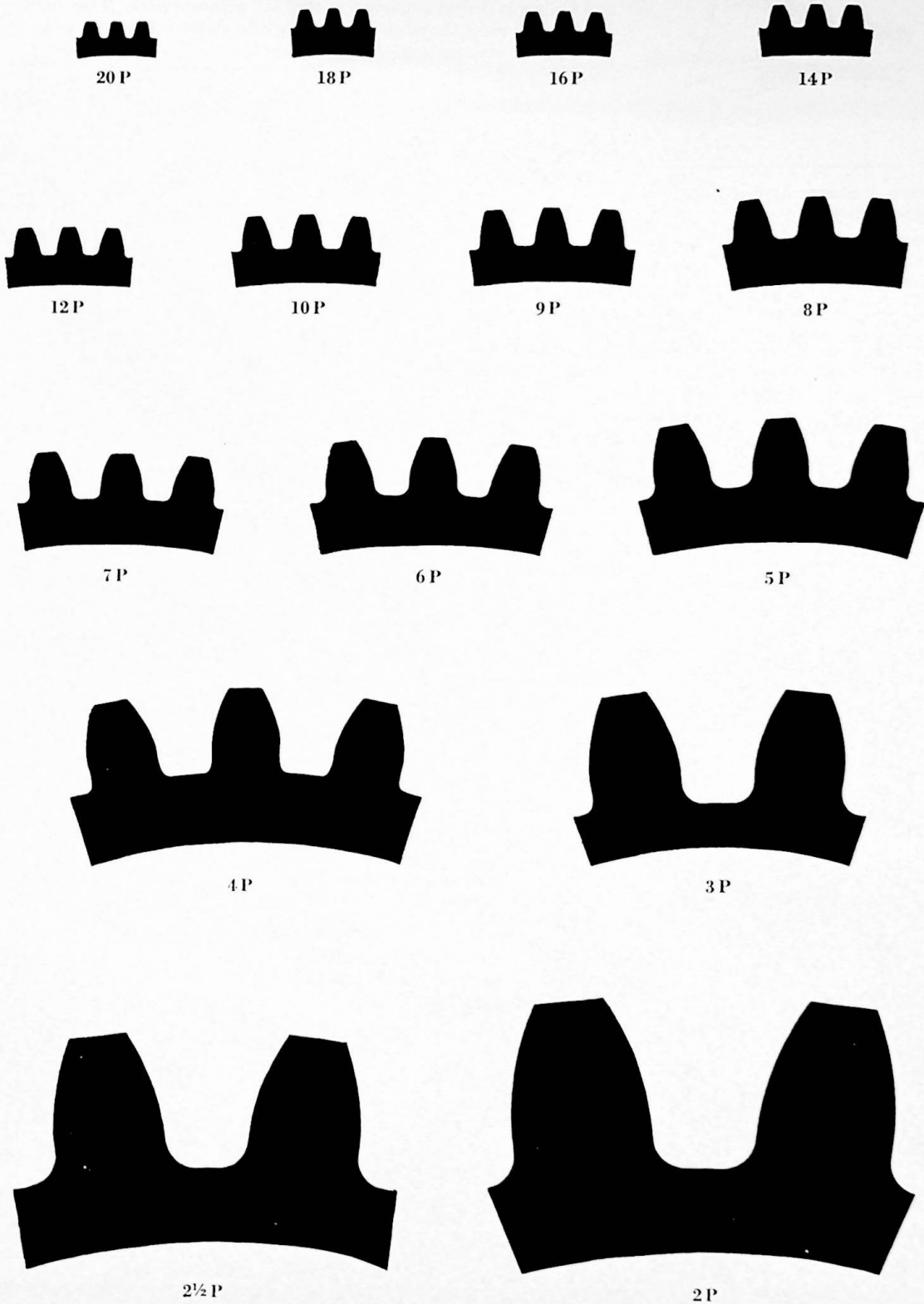
For Use on Brown & Sharpe
No. 5 Automatic Gear Cutting Machine

Diametral Pitch	Diameter, Inches	Hole, Inches	Order by Number
2	5 $\frac{3}{4}$	1 $\frac{1}{2}$	705-610-272
2 $\frac{1}{2}$	5 $\frac{3}{4}$	1 $\frac{1}{2}$	705-610-274
3	5 $\frac{1}{4}$	1 $\frac{1}{2}$	705-610-570
4	4 $\frac{1}{2}$	1 $\frac{1}{2}$	705-610-572
5	4 $\frac{1}{4}$	1 $\frac{1}{2}$	705-610-574
6	3 $\frac{3}{8}$	1 $\frac{1}{2}$	705-610-576

Each of the above packed one in a box.

List of Keyways, page 32.

Comparative Sizes of Gear Teeth
Involute System—Diametral Pitch

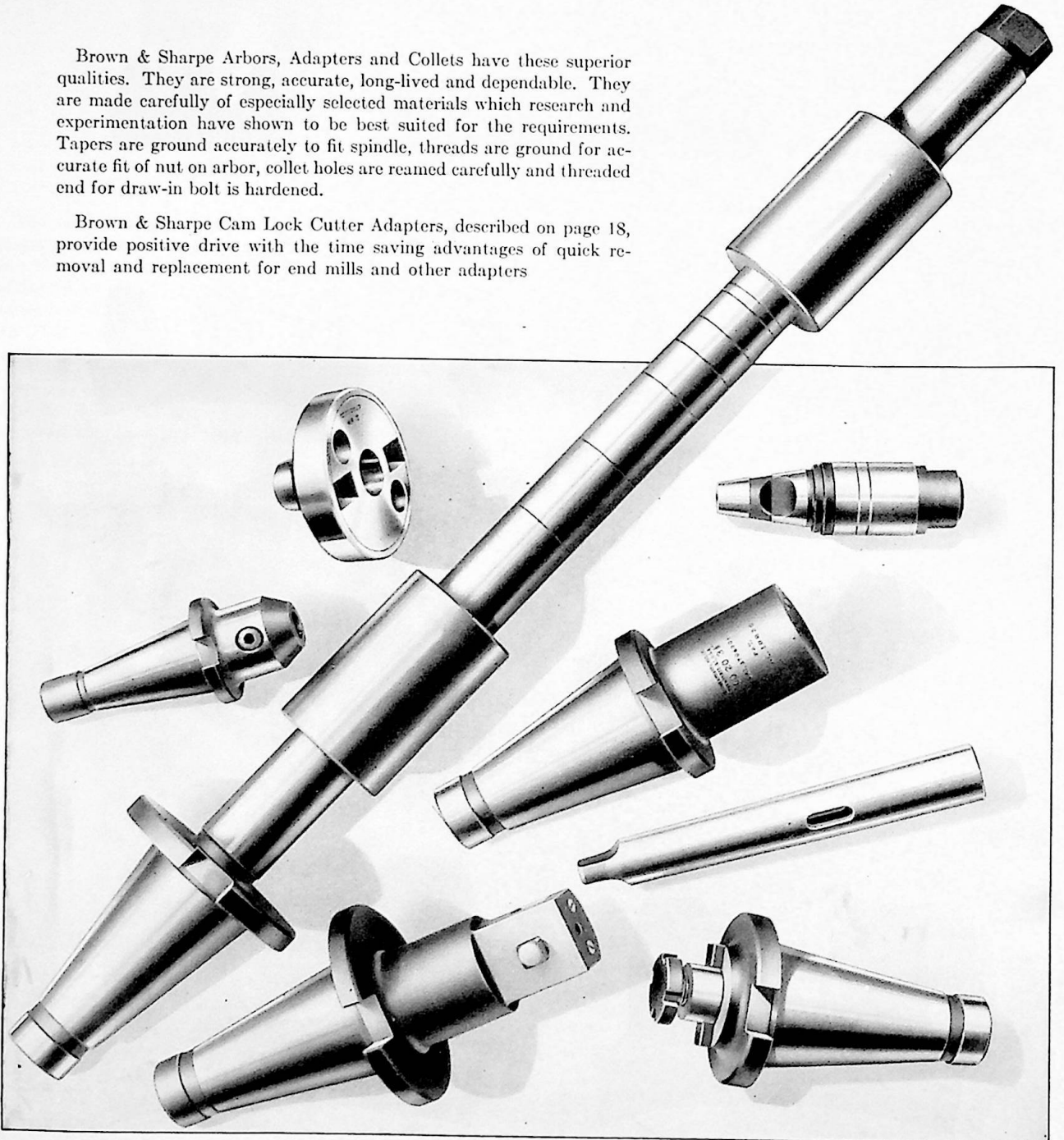


*Arbors,
Adapters
and Collets*

The importance of the Arbor, Adapter or Collet to the milling operation is overlooked frequently. Carefully made, expensive machine tools and fast cutting milling cutters require good Arbors, Adapters and Collets to deliver maximum output and accurate work. They must be strong to resist the strain from heavy cuts without deflection and to provide free, even cutting. And they must be accurate to make possible accurate work.

Brown & Sharpe Arbors, Adapters and Collets have these superior qualities. They are strong, accurate, long-lived and dependable. They are made carefully of especially selected materials which research and experimentation have shown to be best suited for the requirements. Tapers are ground accurately to fit spindle, threads are ground for accurate fit of nut on arbor, collet holes are reamed carefully and threaded end for draw-in bolt is hardened.

Brown & Sharpe Cam Lock Cutter Adapters, described on page 18, provide positive drive with the time saving advantages of quick removal and replacement for end mills and other adapters

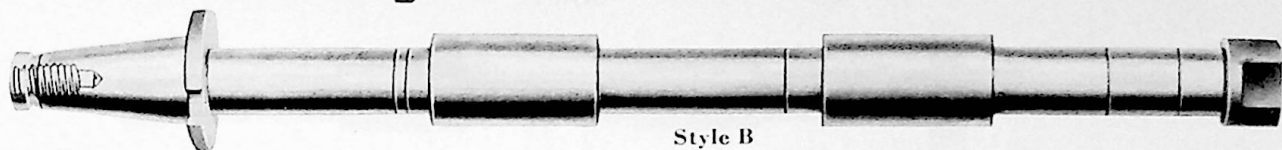


Cutter Arbors

For use on Milling Machines having Standardized Spindle End



Style A (Has pilot $\frac{3}{32}$ " Dia.)



Style B

For Spindles having M.M. Std. Taper Hole No.	Diam. Arbor, Inches	Length, Shoulder to Nut, Inches	Diam. Sleeve, Inches	Style	Sleeves Furnished	O.D. of Collars, Inches	Threaded Hole	Order by Number	Old Catalog Number
40	$\frac{7}{8}$	10	...	A	0	$1\frac{3}{8}$	5/8" 11 N.C., R.H.	719-2	40 7/8 A10
40	$\frac{7}{8}$	16	$1\frac{7}{8}$	A	1	$1\frac{3}{8}$		719-4	40 7/8 A16-3
40	1	10	...	A	0	$1\frac{5}{8}$		719-6	41 A10
40	1	12	...	A	0	$1\frac{5}{8}$		719-8	41 A12
40	$1\frac{1}{4}$	12	...	A	0	$1\frac{7}{8}$		719-10	41 1/4 A12
40	1	16	$1\frac{7}{8}$	A	1	$1\frac{5}{8}$		719-12	41 A16-3
40	$1\frac{1}{4}$	16	$1\frac{7}{8}$	A	1	$1\frac{7}{8}$		719-14	41 1/4 A16-3
40	$\frac{7}{8}$	14	$1\frac{7}{8}$	B	1	$1\frac{3}{8}$		719-16	40 7/8 B14-3
40	1	14	$1\frac{7}{8}$	B	1	$1\frac{5}{8}$		719-18	41 B14-3
40	$1\frac{1}{4}$	14	$1\frac{7}{8}$	B	1	$1\frac{7}{8}$		719-20	41 1/4 B14-3
50	$\frac{7}{8}$	10	...	A	0	$1\frac{3}{8}$	1" 8 N.C., R.H.	719-22	50 7/8 A10
50	1	12	...	A	0	$1\frac{5}{8}$		719-24	51 A12
50	$1\frac{1}{4}$	12	...	A	0	$1\frac{7}{8}$		719-26	51 1/4 A12
50	1	18	$2\frac{1}{8}$	A	1	$1\frac{5}{8}$		719-28	51 A18-4
50	$1\frac{1}{4}$	18	$2\frac{1}{8}$	A	1	$1\frac{7}{8}$		719-30	51 1/4 A18-4
50	1	15	$2\frac{1}{8}$	B	1	$1\frac{5}{8}$		719-32	51 B15-4
50	$1\frac{1}{4}$	15	$2\frac{1}{8}$	B	1	$1\frac{7}{8}$		719-34	51 1/4 B15-4
50	$1\frac{1}{2}$	15	$2\frac{1}{8}$	B	1	$2\frac{1}{8}$		719-36	51 1/2 B15-4
50	1	18	$2\frac{1}{8}$	B	2	$1\frac{5}{8}$		719-38	51 B18-4
50	$1\frac{1}{4}$	18	$2\frac{1}{8}$	B	2	$1\frac{7}{8}$		719-40	51 1/4 B18-4
50	$1\frac{1}{2}$	18	$2\frac{1}{8}$	B	2	$2\frac{1}{8}$	719-42	51 1/2 B18-4	
50	1	24	$2\frac{1}{8}$	B	2	$1\frac{5}{8}$	1" 8 N.C., R.H.	719-44	51 B24-4
50	$1\frac{1}{4}$	24	$2\frac{1}{8}$	B	2	$1\frac{7}{8}$		719-46	51 1/4 B24-4
50	$1\frac{1}{2}$	24	$2\frac{1}{8}$	B	2	$2\frac{1}{8}$		719-48	51 1/2 B24-4
50	1	24	$2\frac{3}{4}$	B	2	$1\frac{5}{8}$		719-50	51 B24-5
50	$1\frac{1}{4}$	24	$2\frac{3}{4}$	B	2	$1\frac{7}{8}$		719-52	51 1/4 B24-5
50	$1\frac{1}{2}$	24	$2\frac{3}{4}$	B	2	$2\frac{1}{8}$		719-54	51 1/2 B24-5
50	$1\frac{1}{2}$	30	$2\frac{3}{4}$	B	2	$2\frac{1}{8}$		719-56	51 1/2 B30-5
50	$1\frac{1}{2}$	36	$2\frac{3}{4}$	B	2	$2\frac{1}{8}$		719-58	51 1/2 B36-5
50	2	24	$2\frac{3}{4}$	B	2	$2\frac{11}{16}$		719-60	52 B24-5
50	2	30	$2\frac{3}{4}$	B	2	$2\frac{11}{16}$		719-62	52 B30-5
50	2	36	$2\frac{3}{4}$	B	2	$2\frac{11}{16}$	719-64	52 B36-5	

Thread for nut is Left-Hand.

For Hardened Sleeves, see page 49.

Cutter Arbors—Metric

For use on Milling Machines having Standardized Spindle End

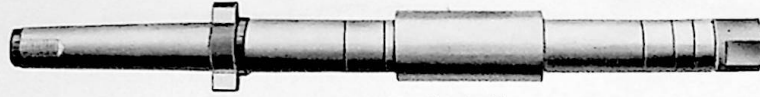
For Spindles having M.M. Std. Taper Hole No.	Diam. Arbor, Mm.	Length, Shoulder to Nut, Inches	Diam. Sleeve, Inches	Style	Sleeves Furnished	O.D. of Collars, Inches	Threaded Hole	Order by Number	Old Catalog Number
40	22	10	...	A	0	$1\frac{3}{8}$	5/8" 11 N.C., R.H.	719-3	40A22MM10
40	27	16	$1\frac{7}{8}$	A	1	$1\frac{5}{8}$		719-13	40A27MM16-3
40	32	16	$1\frac{7}{8}$	A	1	$1\frac{7}{8}$		719-15	40A32MM16-3
50	22	10	...	A	0	$1\frac{3}{8}$	1" 8 N.C., R.H.	719-23	50A22MM10
50	27	18	$2\frac{1}{8}$	B	2	$1\frac{5}{8}$		719-39	50B27MM18-4
50	32	18	$2\frac{1}{8}$	B	2	$1\frac{7}{8}$		719-41	50B32MM18-4
50	40	24	$2\frac{1}{8}$	B	2	$2\frac{1}{8}$		719-49	50B40MM24-4

Thread for nut is Left-Hand.

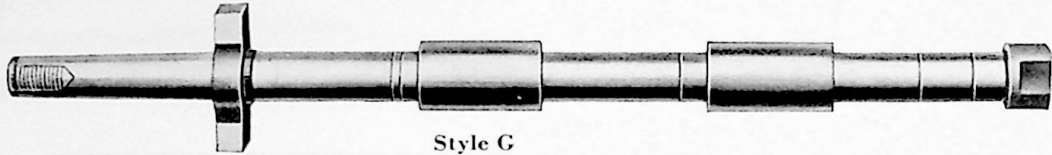
For Prices, See Separate Section

Cutter Arbors

For use on Brown & Sharpe Milling Machines having Taper-Nose Spindle



Style F



Style G

No. of B&S Taper Shank	Diam. of Arbor, Inches	Length, Shoulder to Nut, Inches	Diam. Sleeve, Inches	Style	Sleeves Furnished	O.D. of Collars, Inches	Threaded Hole	Order by Number	Old Catalog Number
10	7/8	12	1 13/16	F	1	1 3/8	1/2" 14 B&S, L.H.	719-100	501
10	1	12	1 13/16	F		1 5/8		719-102	502
10	1	17	1 13/16	F		1 5/8		719-104	505
10	1 1/4	17	1 13/16	F		1 13/16		719-106	506
10	1	17	1 13/16	G		1 5/8		719-108	505A
10	1 1/4	17	1 13/16	G		1 13/16		719-110	506A
11	1	16 1/4	2 1/16	G	2	1 5/8	3/4" 12 B&S, L.H.	719-112	511
11	1 1/4	19 3/4	2 1/16	G		1 7/8		719-114	512
11	1 1/2	19 3/4	2 1/16	G		2 1/16		719-116	513
11	1	22	2 1/16	G		1 5/8		719-118	515
11	1 1/4	26	2 1/16	G		1 7/8		719-120	516
11	1 1/2	26	2 1/16	G		2 1/16		719-122	517
12	1	22	2 5/16	G		1 5/8		719-124	520
12	1 1/4	26 3/4	2 5/16	G		1 7/8		719-126	521
12	1 1/2	26 3/4	2 5/16	G		2 1/8		719-128	522
14	1	25	2 9/16	G		1 5/8		1" 10	719-130	530
14	1 1/4	29	2 9/16	G	1 7/8	B&S,L.H.	719-132	531	

Thread for nut is Left-Hand.

Cutter Arbors

For use on Brown & Sharpe Milling Machines having Threaded-Nose Spindle



Style A



Style B



Style C



Style D



Style E

Listings on opposite page.

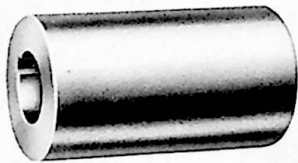
For Prices, See Separate Section

Cutter Arbors (Cont'd)

For use on Brown & Sharpe Milling Machines having Threaded-Nose Spindle

No. of B&S Taper Shank	Diam. Arbor, Inches	Length, Shoulder to Nut, Inches	Diam. Sleeve, Inches	Sleeves Furnished	Style	O.D. of Collars, Inches	Order by Number	Old Catalog Number
7	1/2	3	...	0	A	13/16	719-150	05
9	5/8	4	...		A	1 1/8	719-152	07
9	7/8	5 1/4	...		A	1 3/8	719-154	08
9	1	5 1/4	...		A	1 5/8	719-156	09
9	5/8	8	1 7/8	1	B	1 1/8	719-158	010
9	7/8	8	1 7/8		B	1 3/8	719-160	011
9	1	8	1 7/8		B	1 5/8	719-162	012
9	1	12	1 13/16		B	1 5/8	719-164	013
10	5/8	4	...	0	A	1 1/8	719-166	1
10	7/8	5 1/4	...		A	1 3/8	719-168	6
10	1	5 1/4	...		A	1 5/8	719-170	7
10	1 1/4	5 1/4	...		A	1 7/8	719-172	9
10	7/8	8	...	1	A	1 3/8	719-174	10
10	1	8	...		A	1 5/8	719-176	11
10	1 1/4	8	...		A	1 7/8	719-178	13
10	7/8	12	1 13/16		B	1 3/8	719-180	40
10	1	12	1 13/16	1	B	1 5/8	719-182	41
10	1 1/4	12	1 13/16		B	1 13/16	719-184	43
10	7/8	17	1 13/16		B	1 3/8	719-186	44
10	1	17	1 13/16		B	1 5/8	719-188	45
10	1 1/4	17	1 13/16	2	B	1 13/16	719-190	47
10	1	14 1/2	1 13/16		D	1 5/8	719-192	53
10	1 1/4	14 1/2	1 13/16		D	1 13/16	719-194	55
11	7/8	10 1/4	...		0	A	1 3/8	719-196	15
11	1	10 1/4	...	A		1 5/8	719-198	16
11	1	18	2 1/16	C		1 5/8	719-200	49A
11	7/8	16 1/4	2 1/16	E		1 3/8	719-202	35A
11	1	16 1/4	2 1/16	2	E	1 5/8	719-204	36A
11	1 1/4	19 3/4	2 1/16		E	1 7/8	719-206	38A
11	1 1/2	19 3/4	2 1/16		E	2 1/16	719-208	39A
11	1	22	2 5/16		E	1 5/8	719-210	65A
11	1 1/4	26 3/4	2 5/16	1	E	1 7/8	719-212	66A
11	1 1/2	26 3/4	2 5/16		E	2 1/8	719-214	67A
12	1 1/4	29	2 5/16		E	1 7/8	719-216	70A
12	1 1/2	29	2 5/16		E	2 1/16	719-218	71A

Thread for nut is Left-Hand.

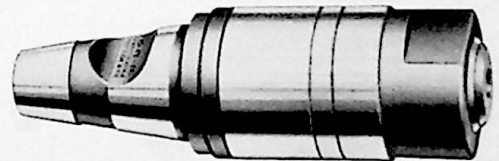


Hardened Steel Sleeves

For Arbors used on Milling Machines

Cam Lock Arbors

For use with Cutter Adapters and Milling Attachment Spindles with Cam Lock



No. of Sleeve	Diam. Sleeve, Inches	Diam. Hole, Inches	Length, Inches	Order by Number
3	1 7/8	5/8	3 1/8	719-9158-9
3	1 7/8	7/8	3 1/8	719-9001-9
3	1 7/8	1	3 1/8	719-9012-9
3	1 7/8	1 1/4	3 1/8	719-9014-9
4	2 1/8	1	3 3/4	719-9028-9
4	2 1/8	1 1/4	3 3/4	719-9040-9
4	2 1/8	1 1/2	3 3/4	719-9036-9
5	2 3/4	1	4 1/4	719-9050-9
5	2 3/4	1 1/4	4 1/4	719-9052-9
5	2 3/4	1 1/2	4 1/4	719-9051-9
5	2 3/4	2	4 1/4	719-9060-9

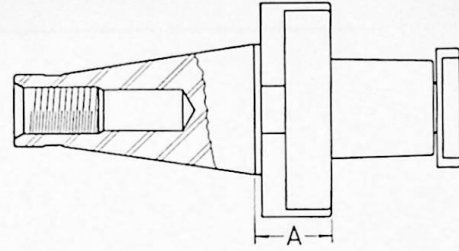
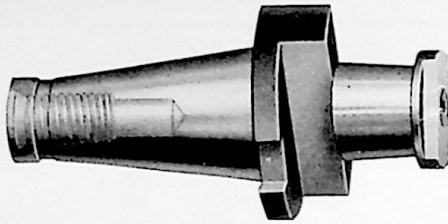
For use in M.M. Std. Taper Hole No.	Diam. Arbor, Inches	Length, Shoulder to Nut, Inches	O.D. of Collars, Inches	Order by Number	Old Catalog Number
30	7/8	2	1 3/8	719-260	30 7/8 D2
30	1	2	1 5/8	719-262	31 D2

For Cam Lock, see page 18.
Thread for nut is Left-Hand.

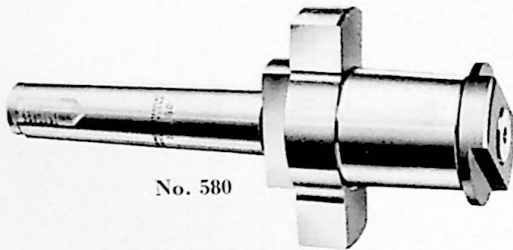
For Prices. See Separate Section

Arbor for Face Milling Cutters

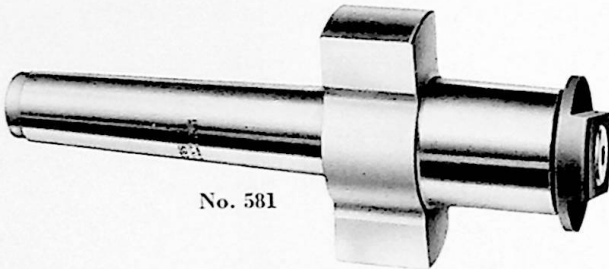
For use on Milling Machines having Standardized Spindle End



For Spindles having M.M. Std. Taper Hole No.	No. of B&S Taper for Mill	A, Projection from Spindle End, Inches	Threaded Hole	Order by Number	Old Catalog Number
50	14	1 $\frac{5}{16}$	1" 8 N.C., R.H.	719-266	50



No. 580



No. 581

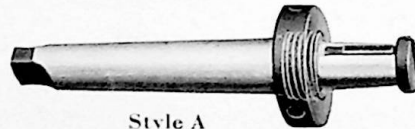
Arbors for Face Milling Cutters

For use on Brown & Sharpe Milling Machines having Taper-Nose Spindle

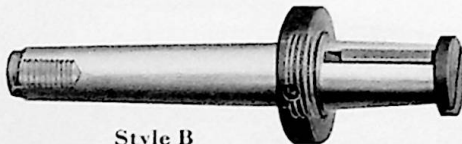
No. of B&S Taper Shank	No. of B&S Taper for Mill	Threaded Hole	Order by Number	Old Catalog Number
10	14	$\frac{1}{2}$ " 14 B&S, L.H.	719-268	580
11	14	$\frac{3}{4}$ " 12 B&S, L.H.	719-270	581

Arbors for Face Milling Cutters

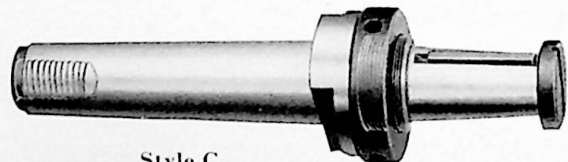
For use on Brown & Sharpe Milling Machines having Threaded-Nose Spindle



Style A



Style B



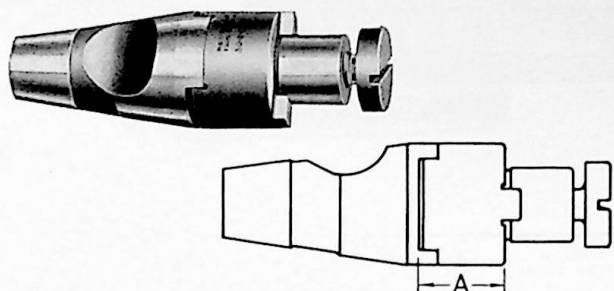
Style C

No. of B&S Taper Shank	No. of B&S Taper for Mill	Style	Threaded Hole	Order by Number	Old Catalog Number
10	10	A	.....	719-276	79
11	12	A	.....	719-278	82
11	12	B	} $\frac{3}{4}$ " 12 B&S, L.H.	719-280	81
11	10	C		719-282	80
11	12	C		719-284	83
12	12	C		719-286	87

For Prices, See Separate Section

Arbors for Shell End Mills

For use in Cutter Adapters and Milling Attachment Spindles with Cam Lock



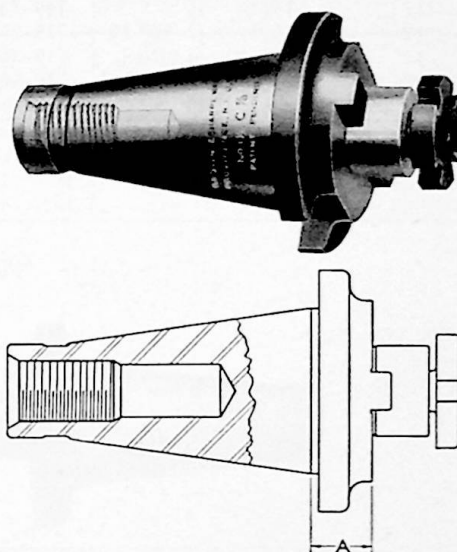
For use in M.M. Std. Taper Hole No.	Diam. of Hole in Shell End Mill, Inches	A, Projection from Spindle End, Inches	Order by Number	Old Catalog Number
30	1/2	13/16	719-300	30 1/2 C 7/8
30	3/4	7/8	719-302	30 3/4 C 7/8
30	1	7/8	719-304	31 C 7/8

For Cam Lock, see page 18.

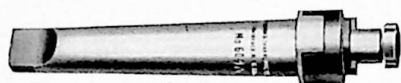
Arbors for Shell End Mills

For use on Milling Machines having Standardized Spindle End

For Spindles having M.M. Std. Taper Hole No.	Diam. of Hole in Shell End Mill, Inches	A, Projection from Spindle End, Inches	Threaded Hole	Order by Number	Old Catalog Number
40	1/2	11/16	5/8" 11 N.C., R.H.	719-306	40 1/2 C 5/8
40	3/4	11/16		719-308	40 3/4 C 5/8
40	1	15/16		719-310	41 C 7/8
40	1 1/4	15/16		719-312	41 1/4 C 7/8
40	1 1/2	15/16		719-314	41 1/2 C 7/8
50	1/2	3/4	1" 8 N.C., R.H.	719-316	50 1/2 C 5/8
50	3/4	3/4		719-318	50 3/4 C 5/8
50	1	1		719-320	51 C 7/8
50	1 1/4	1		719-322	51 1/4 C 7/8
50	1 1/2	1		719-324	51 1/2 C 7/8
50	2	1		719-326	52 C 7/8

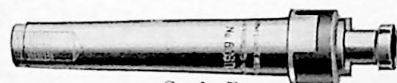


Arbors for Shell End Mills



Style A

For use in Adapters on Milling Machines having Standardized Spindle End



Style B

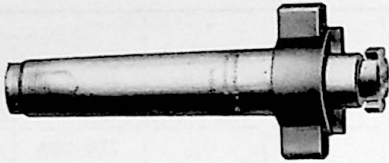
For use in Vertical Milling Attachments having No. 9 Brown & Sharpe Taper Hole

No. of B&S Taper Shank	Diam. Hole, in End Mill, Inches	Style	Threaded Hole	Order by Number	Old Catalog Number
7	1/2	A	.....	719-330	600A
9	1/2	A	.....	719-332	601A
9	1/2	B	7/16" 14 B&S, L.H.	719-334	601B
9	1/2	B	1/2" 13 N.C., R.H.	719-335	601-3
9	3/4	A	.....	719-336	602A
9	3/4	B	7/16" 14 B&S, L.H.	719-338	602B
9	3/4	B	1/2" 13 N.C., R.H.	719-339	602-3
9	1	A	.....	719-340	603A
9	1	B	7/16" 14 B&S, L.H.	719-342	603B
9	1	B	1/2" 13 N.C., R.H.	719-343	603-3
10	3/4	A	.....	719-366	619
10	1	A	.....	719-368	620
10	1 1/4	A	.....	719-344	604A

For Prices, See Separate Section

Arbors for Shell End Mills

For use on Brown & Sharpe Milling Machines having Taper-Nose Spindle



No. of B&S Taper Shank	Diam. Hole in End Mill, Inches	Threaded Hole	Order by Number	Old Catalog Number
10	3/4	1/2" 14 B&S, L.H.	719-350	611
10	1		719-352	612
10	1 1/4		719-354	613
11	1 1/4	3/4" 12 B&S, L.H.	719-356	614
12	1 1/4		719-358	615
11	1 1/2		719-360	616
12	1 1/2	L.H.	719-362	617
12	2		719-364	618

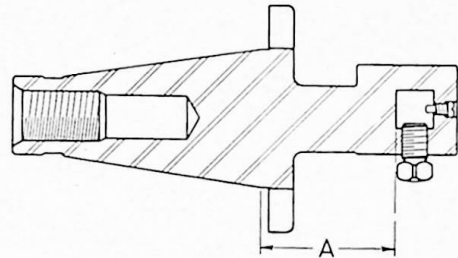
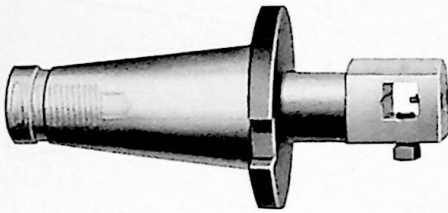
For use on Brown & Sharpe Milling Machines having Threaded-Nose Spindle



No. of B&S Taper Shank	Diam. Hole in End Mill, Inches	Threaded Hole	Order by Number	Old Catalog Number
11	1 1/4	3/4" 12 B&S, L.H.	719-370	621
12	1 1/4		719-372	622
11	1 1/2		719-374	623
12	1 1/2	L.H.	719-376	624
12	2		719-378	625

Fly Cutter Arbors

For use on Milling Machines having Standardized Spindle End

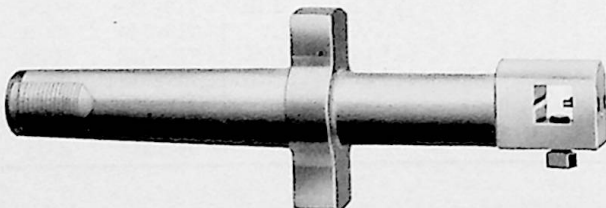


Includes tool with 1/8" radius.

For Spindles having M.M. Std. Taper Hole No.	Square Hole, Size, Inches	A, Projection from Spindle End, Inches	Threaded Hole	Order by Number	Old Catalog Number
40	3/4	3 3/2	5/8" 11 N.C., R.H.	719-384	40
50	3/4	3 5/8	1" 8 N.C., R.H.	719-386	50

Fly Cutter Arbors

For use on Brown & Sharpe Milling Machines having Taper-Nose Spindle

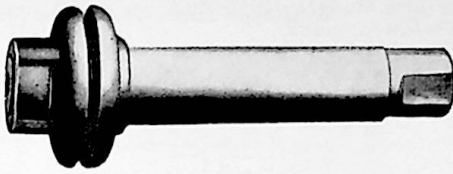


Includes tool with 1/8" radius.

No. of B&S Taper Shank	Square Hole, Size, Inches	Threaded Hole	Order by Number	Old Catalog Number
10	3/4	1/2" 14 B&S, L.H.	719-390	590
11	3/4	3/4" 12 B&S, L.H.	719-392	591

For Prices, See Separate Section

Screw Slotting Cutter Arbors

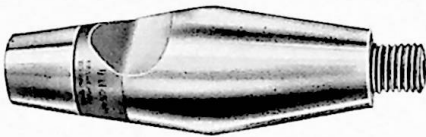


For use on centers.

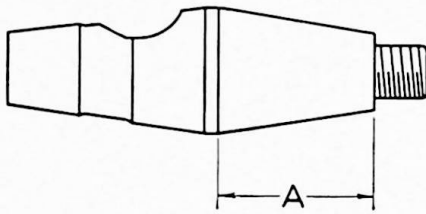
Diam., Hole in Cutter, Inches	Order by Number
$\frac{1}{2}$	719-400
$\frac{5}{8}$	719-402
$\frac{3}{4}$	719-404
1	719-406

Screw Arbors

For use with Cutter Adapters and Milling Attachment Spindles with Cam Lock



For cutters with threaded holes.



For use in M.M. Standard Taper Hole No.	For Cutters with Threaded Hole	A, Projection from Spindle End, Inches	Order by Number	Old Catalog Number
30	$\frac{3}{8}$ " 24 N.F., L.H.	$1\frac{1}{16}$	719-410	30 $\frac{3}{8}$ -24
30	$\frac{3}{8}$ " 24 N.F., R.H.	$1\frac{1}{16}$	719-411	30 $\frac{3}{8}$ -24
30	$\frac{1}{2}$ " 20 N.F., L.H.	$1\frac{1}{2}$	719-412	30 $\frac{1}{2}$ -20
30	$\frac{1}{2}$ " 20 N.F., R.H.	$1\frac{1}{2}$	719-413	30 $\frac{1}{2}$ -20

For Cam Lock, see page 18.

Screw Arbors

For use on Brown & Sharpe Milling Machines having Threaded-Nose Spindle

For cutters with threaded holes.

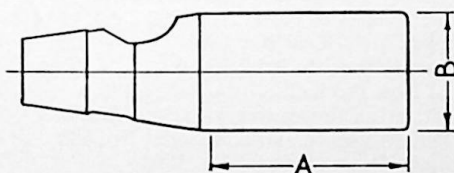
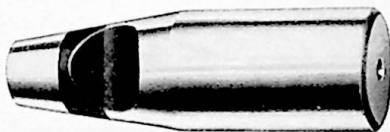
No. of B&S Taper Shank	For Cutters with Threaded Hole	Order by Number	Old Catalog Number
7	$\frac{3}{8}$ " 24 N.F., L.H.	719-420	220
7	$\frac{3}{8}$ " 24 N.F., R.H.	719-422	221
9	$\frac{1}{2}$ " 20 N.F., L.H.	719-424	222
9	$\frac{1}{2}$ " 20 N.F., R.H.	719-426	223



Drill Chuck Arbor Blank

For use with Cutter Adapters and Milling Attachment Spindles with Cam Lock

The end which holds Drill Chuck is left unhardened so that it can be finished to the size required for drill chuck with which it is to be used.



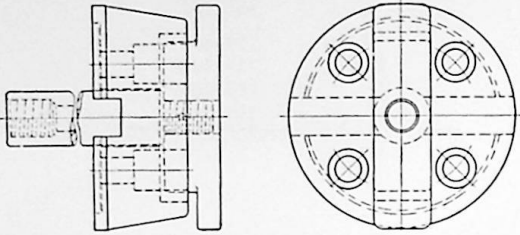
For use in M.M. Standard Taper Hole No.	A, Projection from Spindle End, Inches	B, Inches	Order by Number
30	$2\frac{1}{16}$	$1\frac{1}{4}$	719-430

For Cam Lock, see page 18.

For Prices. See Separate Section

Cutter Adapter

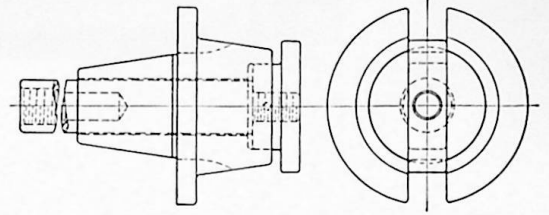
For use on Milling Machines having No. 50 Taper Standardized Spindle End, to accommodate Brown & Sharpe Taper-Hole Face Milling Cutters



Dimensions of Taper Portion are similar to large 5 1/4" Taper-Nose Spindle. Four holding screws attach this adapter securely to Standardized Spindle. Draw-In Bolt then secures cutter with cutter driver as on Taper-Nose Spindle. Made to order.

Cutter Adapter

For use on Milling Machines having No. 50 Taper Standardized Spindle End, to accommodate Brown & Sharpe Taper-Hole Face Milling Cutters



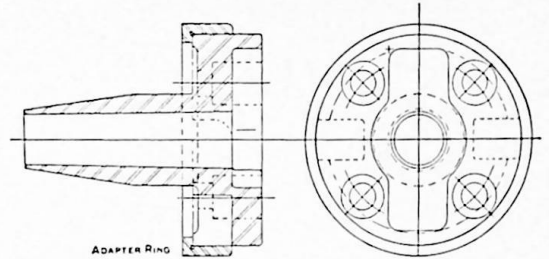
Dimensions of Taper Portion are similar to small 3" Taper-Nose Spindle. Draw-In Bolt draws cutter driver, cutter and adapter securely into Standardized Spindle End. Made to order.

Arbor Adapters

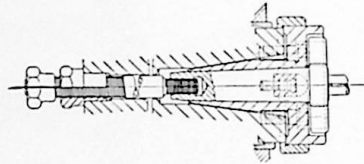
For use on Milling Machines having No. 50 Taper Standardized Spindle End

Permit the use of arbors designed for use with Taper-Nose Spindle on Milling Machines having No. 50 Taper Standardized Spindle End.

Accommodates Arbors with B&S Taper Shank No.	Order by Number	Old Catalog No.
10	719-490	10A
11	719-492	11
12	719-494	12



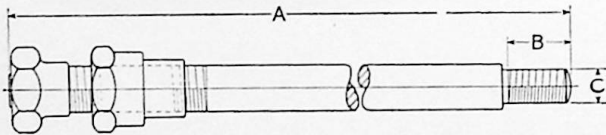
For Draw-In Bolts for use with these Arbor Adapters, see listings below.



Method of Using Arbor Adapters on Milling Machines having Standardized Spindle End

Draw-In Bolts

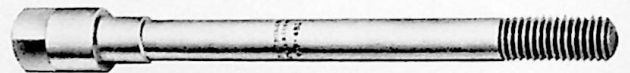
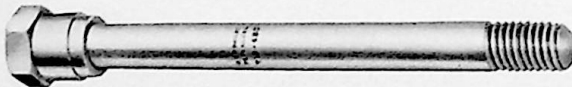
For use with Arbor Adapters Nos. 10A, 11 and 12



A, Inches	B, Inches	C	Order by Number	Old Catalog Number
27 1/16	1 1/8	1/2" 14 B&S, L.H.	719-470	10A
28 9/16	1 3/8	3/4" 12 B&S, L.H.	719-472	11
32 1/16	1 3/8	3/4" 12 B&S, L.H.	719-474	12

Draw-In Bolts

For use with Milling Machine Attachments

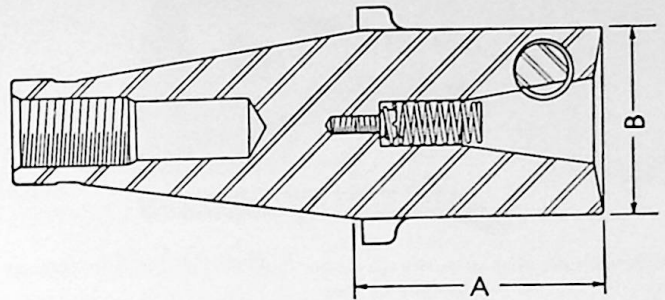
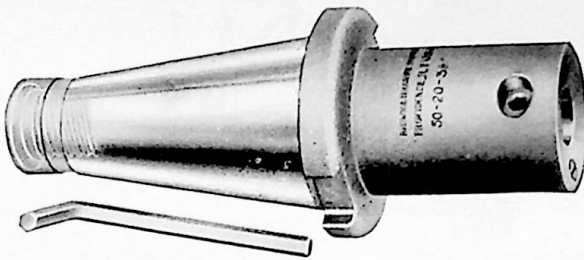


Overall Length, Inches	Length of Thread, Inches	Diam. and Threads per Inch	No. of Attachment where used	Order by Number
6 11/16	1 1/8	1/2" 13 N.C., R.H.	No. 0 Univ. Mill. Att. Commencing With Serial No. 1895	719-480
6 5/8	1	7/16" 14 N.C., L.H.	No. 0 Univ. Mill. Att. up to and incl. Serial No. 1894	719-481
8	7/8	1/2" 13 N.C., R.H.	No. 22 Univ. Mill. Att. Commencing with Serial No. 6	719-482
8 1/16	1	7/16" 14 N.C., L.H.	No. 22 Univ. Mill. Att. Serial Nos. 1-5 incl.	719-483
3 31/32	1	3/8" 16 N.C., R.H.	Nos. 0, 1 and 2 H.S. Vert. Mill. Att. Commencing with Serial No. 583	719-484
3 13/16	3/4	3/8" 16 N.C., L.H.	Nos. 0, 1 and 2 H.S. Vert. Mill. Att. up to and incl. Serial No. 582	719-485
6 1/8	1 1/8	1/2" 13 N.C., R.H.	No. 12 Univ. Mill. Att. Commencing with Serial No. 1365	719-486
6 1/8	1 1/4	7/16" 14 N.C., L.H.	No. 12 Univ. Mill. Att. up to and incl. Serial No. 1364	719-487

For Prices, See Separate Section

Cutter Adapters

For use on Milling Machines having Standardized Spindle End, to accommodate Brown & Sharpe End Mills, Arbors and Adapters having Milling Machine Standard Taper Shanks with Cam Lock



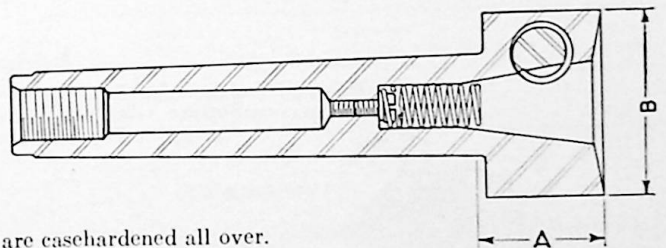
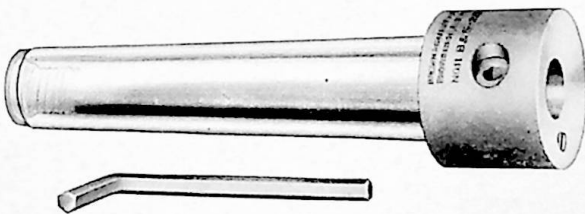
These Cutter Adapters are casehardened all over.

For Spindles having M.M. Std. Taper Hole No.	For End Mills, etc. with M.M. Std. Taper Shank No.	A. Projection from Spindle End, Inches	B, Inches	Threaded Hole	Order by Number	Old Catalog Number
40	10	1 1/16	1 3/4	5/8" 11	719-500	40-10-1 1/2
40	20	1 1/16	2 1/4		N.C.,	719-502
40	30	1 1/16	3	R.H.	719-504	40-30-1 1/2
50	10	1 7/8	1 3/4	1" 8	719-506	50-10-1 3/4
50	20	2	2 1/4		N.C.,	719-508
50	30	2	3	R.H.	719-510	50-30-1 3/4
50	10	3 5/8	1 3/4	R.H.	719-512	50-10-3 1/2
50	20	3 3/4	2 1/4		719-514	50-20-3 1/2
50	30	3 3/4	3		719-516	50-30-3 1/2

For Cam Lock, see page 18.

Cutter Adapters

For use on Brown & Sharpe Milling Machines having either Taper- or Threaded-Nose Spindle to accommodate Brown & Sharpe End Mills, Arbors and Adapters having Milling Machine Standard Taper Shanks with Cam Lock



These Cutter Adapters are casehardened all over.

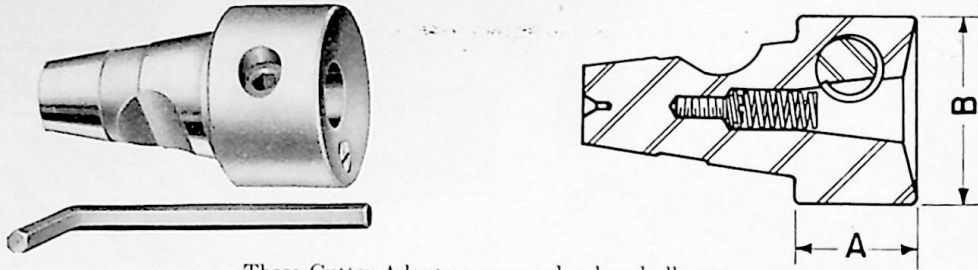
For Spindles having B&S Taper Hole No.	For End Mills, etc. with M.M. Std. Taper Shank No.	A. Projection from Spindle End, Inches	B, Inches	Threaded Hole	Order by Number	Old Catalog Number
9	10	2	1 3/4	1/2" 13	719-523	9 B&S 10-1
9	20	2	2 1/4		N.C.,	719-525
9	30	2 3/8	3	R.H.	719-527	9 B&S 30-1
9	10	2	1 3/4	7/16" 14	719-524	9 B&S 10-2
9	20	2	2 1/4		B&S,	719-526
9	30	2 3/8	3	L.H.	719-528	9 B&S 30-2
10	10	2	1 3/4	1/2" 14	719-530	10 B&S 10-2
10	20	2	2 1/4		B&S,	719-532
10	30	2 1/4	3	L.H.	719-534	10 B&S 30-2 1/2
11	10	2	1 3/4	3/4" 12	719-536	11 B&S 10-2
11	20	2	2 1/4		B&S,	719-538
11	30	2	3	L.H.	719-540	11 B&S 30-2

For Cam Lock, see page 18.

For Prices, See Separate Section

Cutter Adapters

For use with Cutter Adapters and Milling Attachment Spindles with Cam Lock to accommodate Brown & Sharpe End Mills having Milling Machine Standard Taper Shanks with Cam Lock



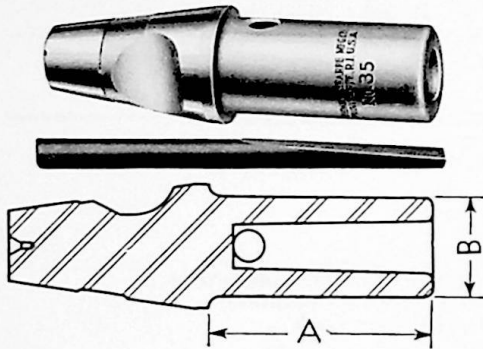
These Cutter Adapters are casehardened all over.

For use in M.M. Std. Taper Hole No.	For End Mills with M.M. Std. Taper Shank No.	A, Projection from Spindle End, Inches	B, Inches	Order by Number	Old Catalog Number
30	10	1 1/8	1 3/4	719-546	30-10-1 1/4
30	20	1 11/32	2 1/4	719-548	30-20-1 1/2

For Cam Lock, see page 18.

Cutter Adapters

For use with Cutter Adapters and Milling Attachment Spindles with Cam Lock to accommodate End Mills and other Cutters having Brown & Sharpe Taper Shanks

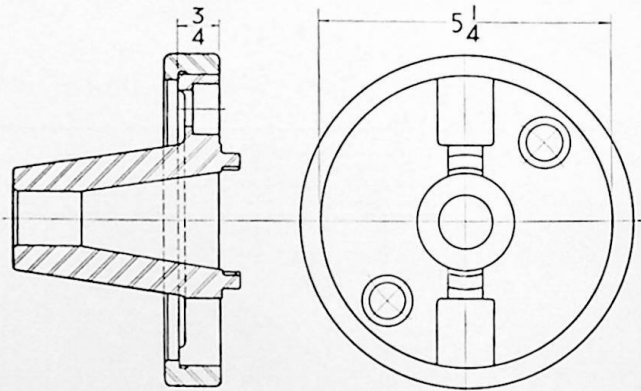
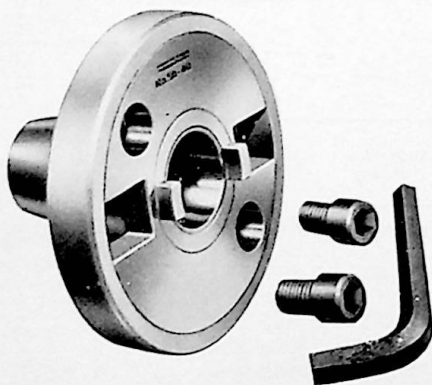


For use in M.M. Std. Taper Hole No.	For End Mills, etc with Taper Shank No.	A, Projection from Spindle End, Inches	B, Inches	Order by Number	Old Catalog Number
30	5 B&S	2 1/4	1	719-552	35
30	7 B&S	4	1 1/4	719-554	37

For Cam Lock, see page 18.

Adapter

For use on Milling Machines having Standardized Spindle End with No. 50 Taper Hole to accommodate Adapters having Milling Machine Standard Taper Shanks No. 40



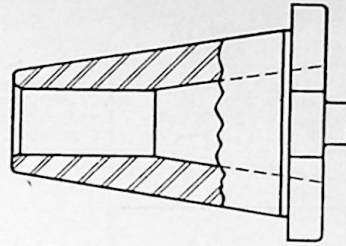
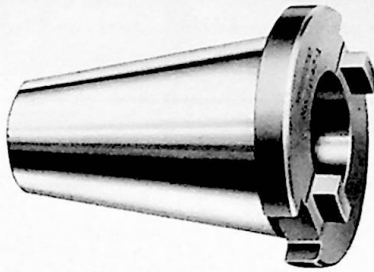
This Adapter bolts securely on Standardized Spindle End No. 50. Has No. 40 Milling Machine Standard Taper Hole which extends through Adapter permitting the use of draw-in bolt in shank of holding tool.

For Spindles having M.M. Std. Taper Hole No.	Accommodates Adapters with M.M. Std. Taper Shanks No.	Projection from Spindle End, Inches	Order by Number	Old Catalog Number
50	40	3/4	719-560	50-40

For Prices, See Separate Section

Adapter

For use on Milling Machines having Standardized Spindle End with No. 50 Taper Hole to accommodate Adapters having Milling Machine Standard Taper Shanks No. 40

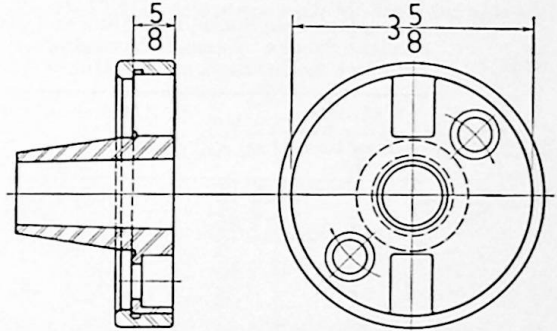
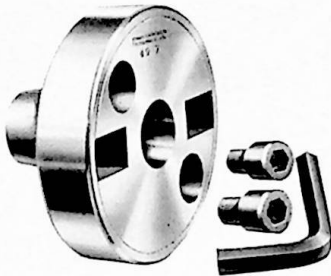


The No. 40 Milling Machine Standard Taper Hole extends through the adapter so that when the draw-in bolt threads into adapters having No. 40 taper shank, it holds both adapters securely and accurately aligned in the spindle end.

For Spindles having M.M. Std. Taper Hole, No.	Accommodates Adapters with M.M. Std. Taper Shanks, No.	Projection from Spindle End, Inches	Order by Number	Catalog Number
50	40	$\frac{5}{8}$	719-559	50-40-1

Adapter

For use on Milling Machines having Standardized Spindle End to accommodate Cutter Adapters and Spring Collets with Straight Holes



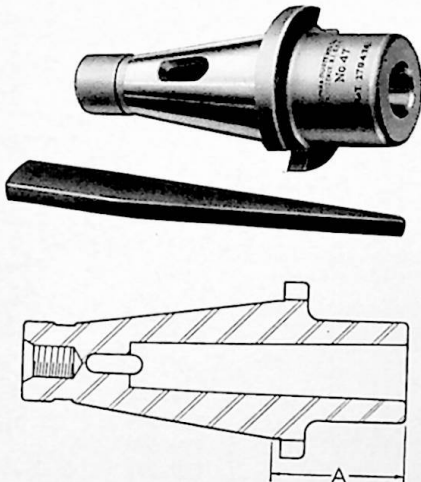
This Adapter bolts securely on Standardized Spindle End No. 40. Has No. 9 Brown & Sharpe Taper Hole which extends through Adapter permitting the use of draw-in bolt in shank of holding tool.

For Spindles having M.M. Std. Taper Hole No.	B&S Taper Hole No.	Projection from Spindle End, Inches	Order by Number	Old Catalog Number
40	9	$\frac{5}{8}$	719-443	49-2

Adapters

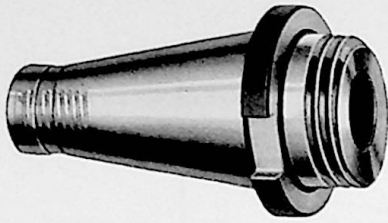
For use on Milling Machines having Standardized Spindle End to accommodate Arbors, Collets and End Mills, having Brown & Sharpe or Morse Taper Shanks

Knock-out Key furnished.



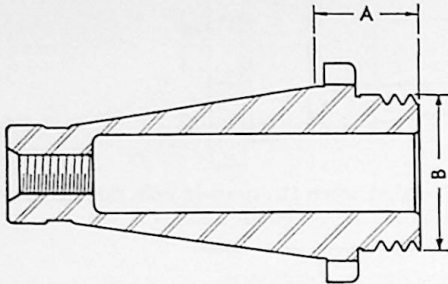
For Spindles having M.M. Std. Taper Hole No.	For Arbors and End Mills having Taper Shank No.	A, Projection from Spindle End, Inches	Threaded Hole	Order by Number	Old Catalog Number
40	3 Morse	$1\frac{13}{16}$	} $\frac{5}{8}$ " 11 U.N.C., R.H.	719-436	43M
40	4 Morse	$3\frac{3}{8}$		719-437	44M
40	5 B&S	$2\frac{1}{2}$		719-438	45
40	7 B&S	$1\frac{13}{16}$		719-440	47
40	9 B&S	$2\frac{3}{4}$		719-442	49
50	3 Morse	$1\frac{1}{4}$		719-445	53M
50	4 Morse	$1\frac{1}{4}$		719-444	54M
50	7 B&S	2		719-446	57
50	9 B&S	$1\frac{1}{4}$		719-448	59
50	10 B&S	$3\frac{1}{8}$		719-450	50-10

For Prices, See Separate Section



Chuck Adapters

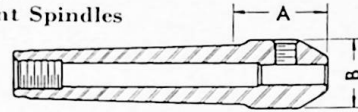
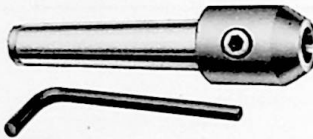
For use on Milling Machines having Standardized Spindle End to provide means of attaching Chucks



For Spindles having M.M. Std. Taper Hole No.	B, Thread of Chuck	A, Projection from Spindle End, Inches	Threaded Hole	Order by Number	Old Catalog Number
40	2 1/4" 4 1/2 N.C., R.H.	1 7/8	5/8" 11 N.C., R.H.	719-160	42 1/4
50	2 1/4" 4 1/2 N.C., R.H.	1 5/8		719-162	52 1/4
50	2 1/2" 4 N.C., R.H.	1 5/8		719-164	52 1/2
50	2 3/4" 4 N.C., R.H.	1 5/8		719-166	52 3/4

Cutter Adapters

For use with Milling Attachment Spindles



Accommodate Spiral Two-Flute and Ball End End Mills, both Single- and Double-End with Straight Shanks. Adapters having 3/4" hole accommodate Cutter Adapter Bushings, also. Safety Set Screw holds Shank of End Mill or Adapter Bushing securely in Adapter.

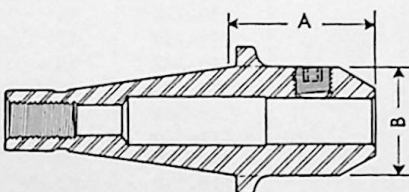
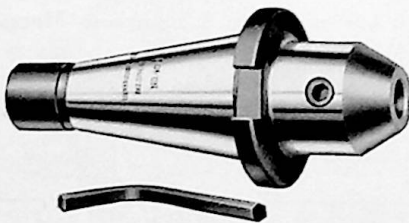
For Spindles having B&S Taper Hole No.	Diam. of Hole, Inches	A, Projection from Spindle End, Inches	B, Inches	Threaded Hole	Order by Number	Old Catalog Number
7	3/16	1 3/16	1 3/16	3/8" 16 N.C., R.H.	719-595	719-595
7	3/8	1 11/16	1		719-597	719-597
7	1/2	1 13/16	1 1/8		719-599	719-599
9	3/16	1 1/4	1 3/16	1/2" 13 N.C., R.H.	719-602	719-602
9	3/8	1 3/4	1 1/4		719-604	719-604
9	1/2	1 7/8	1 1/2		719-606	719-606
9	5/8	2	1 5/8		719-608	719-608
†9	3/4	2 3/16	1 3/4		719-610	719-610

†Accommodates Single-End End Mills only.

Cutter Adapters

For use on Milling Machines having Standardized Spindle End

Accommodate Spiral Two-Flute and Ball End End Mills, both Single-End and Double-End with Straight Shanks. Adapters having 3/4" hole accommodate Cutter Adapter Bushings, also. Safety Set Screw holds Shank of End Mill or Adapter Bushing securely in Adapter. Adapters having holes 7/8" in diameter and larger have two set screws.



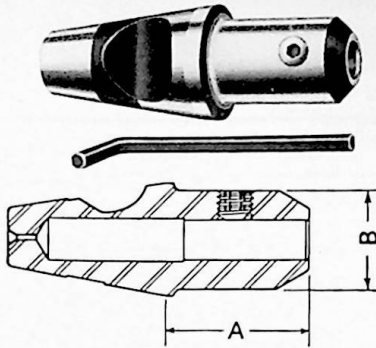
For Spindles having M.M. Std. Taper Hole No.	Diam. of Hole, Inches	A, Projection from Spindle End, Inches	B, Inches	Threaded Hole	Order by Number	Old Catalog Number
40	3/16	1 3/8	1 3/16	5/8" 11 N.C., R.H.	719-565	40 3/16
40	3/8	1 7/8	1 1/4		719-566	40 3/8
40	1/2	2	1 1/2		719-568	40 1/2
40	5/8	2 1/16	1 5/8		719-570	40 5/8
40	3/4	2 3/16	1 3/4		719-572	40 3/4
40	7/8	2 5/8	1 7/8		719-574	40 7/8
†40	1	3	2 1/8		719-575	40-1
†40	1 1/4	3 7/16	2 3/8		719-576	40-1 1/4
50	3/8	2 1/2	1 1/4		719-586	50 3/8
50	1/2	2 1/2	1 1/2		719-587	50 1/2
50	5/8	2 1/2	1 5/8	1" 8 N.C., R.H.	719-588	50 5/8
50	3/4	2 1/2	1 3/4		719-589	50 3/4
50	7/8	2 7/8	1 7/8		719-590	50 7/8
50	1	3 1/4	2 1/8		719-591	50-1
50	1 1/4	3 3/4	2 3/8		719-592	50-1 1/4

For Prices, See Separate Section

†Accommodates Single-End End Mills only.

Cutter Adapters

For use with Cutter Adapters and Milling Attachment Spindles with Cam Lock



For Prices, See Separate Section

Accommodate Spiral, Two-Flute, and Ball End End Mills, Single-End and Double-End with Straight Shanks. Adapters having $\frac{3}{4}$ " hole accommodate Cutter Adapter Bushings, also. Safety Set Screw holds Shank of End Mill or Adapter Bushing securely in Adapter.

For use in M.M. Std. Taper Hole No.	Diameter of Hole, Inches	A, Projection from Spindle End, Inches	B, Inches	Order by Number	Old Catalog Number
30	$\frac{3}{16}$	1	$\frac{13}{16}$	719-577	30 $\frac{3}{16}$
30	$\frac{3}{8}$	$1\frac{1}{2}$	1	719-578	30 $\frac{3}{8}$
30	$\frac{1}{2}$	$1\frac{5}{8}$	$1\frac{1}{8}$	719-580	30 $\frac{1}{2}$
†30	$\frac{5}{8}$	$1\frac{7}{8}$	$1\frac{3}{8}$	719-582	30 $\frac{5}{8}$
†30	$\frac{3}{4}$	$2\frac{1}{4}$	$1\frac{3}{4}$	719-584	30 $\frac{3}{4}$

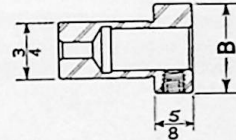
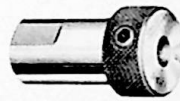
†Accommodates Single-End End Mills only.
For Cam Lock, see page 18.

Cutter Adapter Bushings

For Spiral, Two-Flute and Ball End End Mills, Single-End, with Straight

Shanks. For use with Cutter Adapters Nos. 30 $\frac{3}{4}$, 40 $\frac{3}{4}$, 50 $\frac{3}{4}$ and with Cutter Adapters with $\frac{3}{4}$ " Hole for use with Milling Attachment Spindles

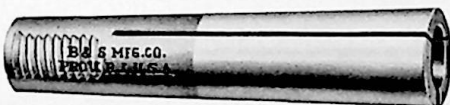
Diam. of Hole, In.	B, Inches	Order by Number	Old Catalog Number
$\frac{1}{8}$	1	719-700	300A
$\frac{5}{32}$	1	719-702	300B
$\frac{3}{16}$	1	719-704	300C
$\frac{7}{32}$	$1\frac{1}{16}$	719-706	300D
$\frac{1}{4}$	$1\frac{1}{16}$	719-708	300E
$\frac{5}{16}$	$1\frac{1}{8}$	719-710	300F
$\frac{3}{8}$	$1\frac{3}{16}$	719-712	300G
$\frac{7}{16}$	$1\frac{1}{4}$	719-714	300H
$\frac{1}{2}$	$1\frac{5}{16}$	719-716	300I
$\frac{9}{16}$	$1\frac{3}{8}$	719-718	300J



Safety Set Screw holds Shank of End Mill securely in Bushing.

Spring Collets with Straight Holes

For use with No. 49-2 Adapter and on Milling Machine and Grinding Machine Attachments

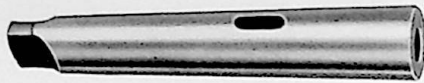


Outside Taper, B&S No.	Diam. of Hole, In.	Depth of Hole, In.	Threaded Hole	Order by Number	
7	$\frac{1}{8}$	$\frac{1}{2}$	$\frac{3}{8}$ " 16 N.C., R.H.	724-100	
7	$\frac{3}{16}$	$\frac{5}{8}$		724-102	
7	$\frac{1}{4}$	$\frac{3}{4}$		724-104	
7	$\frac{5}{16}$	$\frac{7}{8}$		724-106	
7	$\frac{3}{8}$	1		724-108	
7	$\frac{7}{16}$	$1\frac{1}{16}$		724-110	
7	$\frac{1}{2}$	$1\frac{1}{8}$		724-112	
9	$\frac{1}{8}$	$\frac{1}{2}$		$\frac{1}{2}$ " 13 N.C., R.H.	724-114
9	$\frac{3}{16}$	$\frac{5}{8}$			724-116
9	$\frac{1}{4}$	$\frac{3}{4}$			724-118
9	$\frac{5}{16}$	$\frac{7}{8}$	724-120		
9	$\frac{3}{8}$	1	724-122		
9	$\frac{7}{16}$	$1\frac{1}{16}$	724-124		
9	$\frac{1}{2}$	$1\frac{1}{8}$	724-126		
9	$\frac{5}{8}$	$1\frac{3}{8}$	724-128		
9	$\frac{3}{4}$	$1\frac{1}{2}$	724-130		

For Prices, See Separate Section

Collets

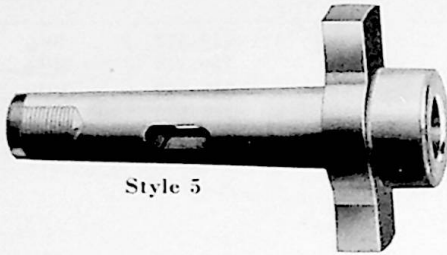
For use on Brown & Sharpe Milling Machines having Taper-Nose Spindle



Style 1



Style 2



Style 5

Collets with Nos. 4 and 5 Taper Holes are for shanks without tenons.

Outside Taper, B&S No.	Inside Taper, B&S No.	Style	Front End of Collet to Face of Spindle, In.	Threaded Hole	Order by Number	Old Catalog Number
7	4	1	5/16		724-2	AA
7	5	2	3/4	3/8" 16 N.C., R.H.	724-10	724-10
9	5	2	3/8		724-18	724-48
9	7	2	7/8	1/2" 13 N.C., R.H.	724-54	724-54
10	5	2	2 1/16		724-4	EF
10	7	2	1 1/4	1/2" 14 B&S, L.H.	724-6	BB
10	9	2	1 1/4		724-8	FF
11	7	2	1 3/4		724-10	QQ
11	9	2	1/4		724-12	O
11	9	5	2		724-14	GO
11	10	5	1 3/4	3/4" 12 B&S, L.H.	724-16	PQ
12	9	2	7/16		724-18	SS
12	9	5	1 1/4		724-20	ST
12	10	5	1 1/2		724-22	OP

Collets

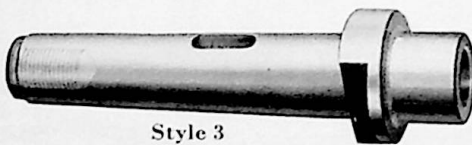
For use on Brown & Sharpe Milling Machines having Threaded-Nose Spindle



Style 1



Style 2



Style 3

Collets with Nos. 4 and 5 Taper Holes take shanks without tenons.

*Styles 2A and 3A similar to 2 and 3 respectively but have no threaded hole.

†Suitable for use on Gear Cutting and Hobbing Machines.

For Prices, See Separate Section

Outside Taper, B&S No.	Inside Taper, B&S No.	Style	Front End of Collet to Face of Spindle, In.	Threaded Hole	Order by Number	Old Catalog Number
7	4	1	1 9/16		724-30	A
7	4	2	5/16	3/8" 16 B&S, L.H.	724-32	J
7	5	1	2 5/16		724-34	N
7	5	1	3/8		724-36	NN
7	5	2	3/4	3/8" 16 B&S, L.H.	724-38	R
7	5	2	3/4		3/8" 16 N.C., R.H.	724-40	724-40.
9	5	1	2 1/8			724-42	C
9	5	1	3/4		724-44	D
9	5	2	3/8	7/16" 14 B&S, L.H.	724-46	K
9	5	2	3/8	1/2" 13 N.C., R.H.	724-48	724-48
9	7	1	3/4		724-50	KK
9	7	2	7/8	7/16" 14 B&S, L.H.	724-52	RR
9	7	2	7/8	1/2" 13 N.C., R.H.	724-54	724-54
10	5	1	2 1/16		724-56	EE
10	7	1	2 5/8		724-58	DD
10	7	1	1 5/8		724-60	E
10	7	2	1 1/4	1/2" 14 B&S, L.H.	724-6	BB
10	7	*2A	1/2		724-64	Z
10	9	1	1		724-66	F
10	9	2	1 1/4	1/2" 14 B&S, L.H.	724-8	FF
11	7	1	1 3/4		724-70	Q
11	9	1	2 3/8		724-72	G
11	9	2	1/4	3/4" 12 B&S, L.H.	724-12	O
11	9	3	1 5/8	3/4" 12 B&S, L.H.	724-76	H
11	10	*3A	1/2		724-78	GG
12	9	2	7/16	3/4" 12 B&S, L.H.	724-18	SS
12	10	†2	7/8	3/4" 12 B&S, R.H.	724-82	V
11	10	1	1 3/8		724-84	P
12	10	*3A	1 11/16		724-86	PP
12	11	†2	1 7/8	3/4" 12 B&S, R.H.	724-88	VV
12	11	*3A	1 11/16		724-90	TT
12	9	3	1 11/16	3/4" 12 B&S, L.H.	724-92	UU
14	10	†2	7/8	3/4" 12 B&S, R.H.	724-94	WW
14	11	†2	7/8	3/4" 12 B&S, R.H.	724-96	W
14	12	†2	7/8	3/4" 12 B&S, R.H.	724-98	WV

Collet Blanks

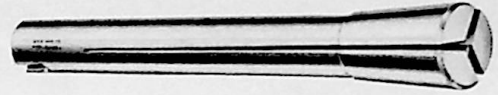


Blanks with Nos. 4 and 5 Taper Holes are for shanks without tenons and have round hole for knockout key.

Diameter, Inches	Length Overall, Inches	B&S Taper Hole, No.	Order by Number
3/4	5 1/4	4	724-202
1 1/8	8 1/2	5	724-204
1 5/8	10	7	724-206
1 7/8	12	9	724-208
2	14	10	724-210

No. 60 Spring Collet

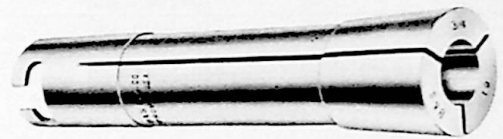
For use on Polishing and Finishing Machine



Size, Inches	Order by Number
1/8	710-508-160
3/16	710-512-160
1/4	710-516-160
5/16	710-520-160
3/8	710-524-160

No. 61 Spring Collet

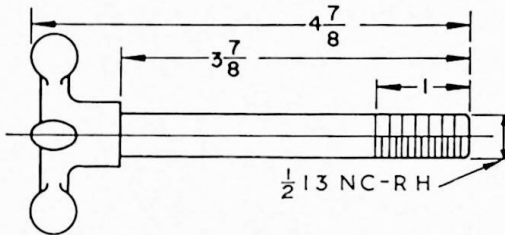
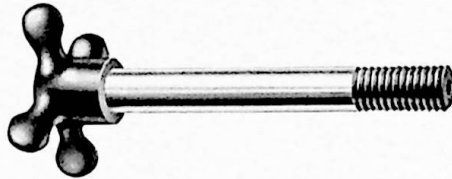
For use on Polishing and Finishing Machine



Size, Inches	Order by Number
7/8	710-556-161
1	710-564-161

Draw-In Bolt

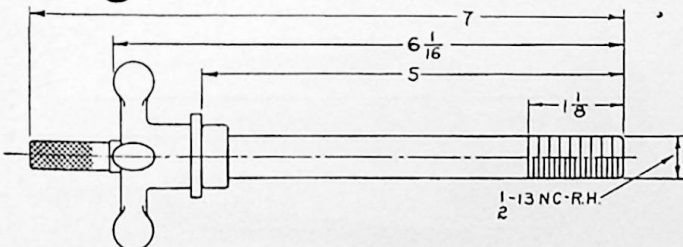
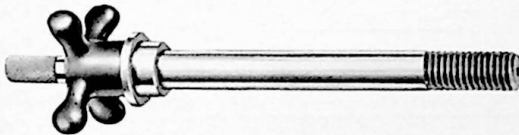
For use in Nos. 10 and 13 End Mill Sharpening Attachments



For use with Spring Collets with Straight Holes having B&S No. 9 outside taper. Threaded end of bolt is case-hardened. Order by Number 724-200.

Draw-In Bolt

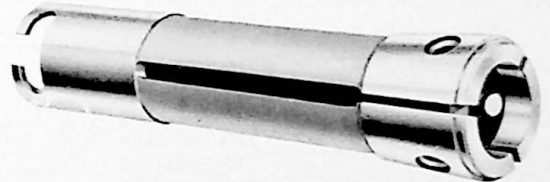
For use in No. 5 Cutter and Tool Grinding Machine and No. 10N End Mill Sharpening Attachment



For use with Spring Collets with Straight Holes having B&S No. 9 outside taper. Threaded end of bolt is case-hardened. Order by Number 724-201.

No. 61M Master Collet

For use on Polishing and Finishing Machine



This Collet accommodates interchangeable sets of three pads for each size in the following round sizes: 1/8", 3/16", 1/4", 5/16", 3/8", 7/16", 1/2", 5/8" and 3/4".

Order by Number 710-548-261

Steel Pads for No. 61M Master Collet

Round

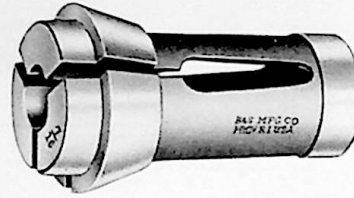
Furnished in sets of three pads for each size.

Size, Inches	Order by Number
1/8	710-31008-261
3/16	710-31012-261
1/4	710-31016-261
5/16	710-31020-261
3/8	710-31024-261
7/16	710-31028-261
1/2	710-31032-261
5/8	710-31040-261
3/4	710-31048-261

For Prices, See Separate Section

Spring Collets

For use with Spring Chucks for Milling Machines



No. 00, for Nos. 150 and 152 Spring Chucks

No. 00 Spring Collets, in sizes $\frac{1}{16}$ " and larger, are flat faced and do not have nose projection shown in illustration.

Round

Size, Inches	Order by Number
$\frac{1}{16}$	710-1004-100
$\frac{3}{64}$	710-1005-100
$\frac{1}{32}$	710-1006-100
$\frac{7}{64}$	710-1007-100
$\frac{1}{8}$	710-1008-100
$\frac{9}{64}$	710-1009-100
$\frac{5}{32}$	710-1010-100
$\frac{11}{64}$	710-1011-100
$\frac{3}{16}$	710-1012-100
$\frac{13}{64}$	710-1013-100
$\frac{7}{32}$	710-1014-100
$\frac{15}{64}$	710-1015-100
$\frac{1}{4}$	710-1016-100
$\frac{17}{64}$	710-1017-100
$\frac{9}{32}$	710-1018-100
$\frac{19}{64}$	710-1019-100
$\frac{5}{16}$	710-1020-100
$\frac{21}{64}$	710-1021-100
$\frac{11}{32}$	710-1022-100
$\frac{23}{64}$	710-1023-100
$\frac{3}{8}$	710-1024-100
$\frac{25}{64}$	710-1025-100
$\frac{13}{32}$	710-1026-100
$\frac{27}{64}$	710-1027-100
$\frac{7}{16}$	710-1028-100
$\frac{29}{64}$	710-1029-100
$\frac{15}{32}$	710-1030-100
$\frac{31}{64}$	710-1031-100
$\frac{1}{2}$	710-1032-100

Square

Size, Inches	Order by Number
$\frac{1}{8}$	710-2008-100
$\frac{5}{32}$	710-2010-100
$\frac{3}{16}$	710-2012-100
$\frac{7}{32}$	710-2014-100
$\frac{1}{4}$	710-2016-100

Hexagonal

Size, Inches	Order by Number
$\frac{1}{8}$	710-3008-100
$\frac{5}{32}$	710-3010-100
$\frac{3}{16}$	710-3012-100
$\frac{7}{32}$	710-3014-100
$\frac{1}{4}$	710-3016-100
$\frac{9}{32}$	710-3018-100
$\frac{5}{16}$	710-3020-100

No. 10, for No. 154 Spring Chuck

No. 10 Spring Collets, in sizes above $\frac{1}{2}$ ", are flat faced and do not have nose projection shown in illustration.

Round

Size, Inches	Order by Number
$\frac{1}{16}$	710-1004-110
$\frac{3}{32}$	710-1006-110
$\frac{7}{64}$	710-1007-110
$\frac{1}{8}$	710-1008-110
$\frac{9}{64}$	710-1009-110
$\frac{5}{32}$	710-1010-110
$\frac{11}{64}$	710-1011-110
$\frac{3}{16}$	710-1012-110
$\frac{13}{64}$	710-1013-110
$\frac{7}{32}$	710-1014-110
$\frac{15}{64}$	710-1015-110
$\frac{1}{4}$	710-1016-110
$\frac{17}{64}$	710-1017-110
$\frac{9}{32}$	710-1018-110
$\frac{19}{64}$	710-1019-110
$\frac{5}{16}$	710-1020-110
$\frac{11}{32}$	710-1022-110
$\frac{3}{8}$	710-1024-110
$\frac{13}{32}$	710-1026-110
$\frac{7}{16}$	710-1028-110
$\frac{15}{32}$	710-1030-110
$\frac{1}{2}$	710-1032-110
$\frac{9}{16}$	710-1036-110
$\frac{5}{8}$	710-1040-110

Square

Size, Inches	Order by Number
$\frac{3}{16}$	710-2012-110
$\frac{1}{4}$	710-2016-110
$\frac{5}{16}$	710-2020-110

Hexagonal

Size, Inches	Order by Number
$\frac{3}{16}$	710-3012-110
$\frac{1}{4}$	710-3016-110
$\frac{5}{16}$	710-3020-110
$\frac{3}{8}$	710-3024-110
$\frac{7}{16}$	710-3028-110

For Prices, See Separate Section

Spring Collets (Cont'd)

For use with Spring Chucks for Milling Machines

No. 21, for Nos. 156, 158, 160, 246 and 256 Spring Chucks

Round	
Size, Inches	Order by Number
1/8	710-1008-121
5/32	710-1010-121
3/16	710-1012-121
7/32	710-1014-121
1/4	710-1016-121
9/32	710-1018-121
5/16	710-1020-121
11/32	710-1022-121
3/8	710-1024-121
13/32	710-1026-121
7/16	710-1028-121
15/32	710-1030-121
1/2	710-1032-121
17/32	710-1034-121
9/16	710-1036-121
19/32	710-1038-121
5/8	710-1040-121
11/16	710-1044-121
3/4	710-1048-121
13/16	710-1052-121

Round (Cont'd)

Size, Inches	Order by Number
7/8	710-1056-121
15/16	710-1060-121
1	710-1064-121

Square

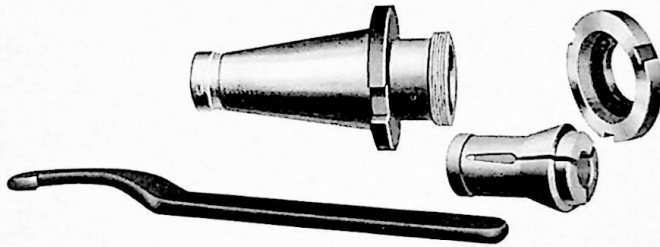
Size, Inches	Order by Number
1/4	710-2016-121
5/16	710-2020-121
3/8	710-2024-121
7/16	710-2028-121

Hexagonal

Size, Inches	Order by Number
1/4	710-3016-121
5/16	710-3020-121
3/8	710-3024-121
7/16	710-3028-121
1/2	710-3032-121

Nos. 246 and 256 Spring Chucks

For use on Milling Machines having Standardized Spindle End



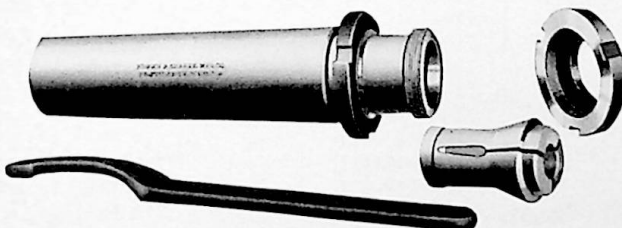
Convenient for holding wire, small rods, straight shank drills, mills and similar pieces. The cap nut forces spring collet against a tapered seat and closes chuck concentrically. Furnished with collet.

For Spindles having M.M. Std. Taper Hole No.	Hole, Inches		Threaded Hole	Round Collet		Order by Number	Old Catalog Number
	Diam.	Depth		No.	Size, In.		
40	3/4	5 15/16	5/8" 11 N.C., R.H.	21	1/2	788-246	246
50	1 1/2	6 1/4		21	5/8	788-256	256

Nos. 150, 152, 154, 156, 158 and 160 Spring Chucks

For use on Milling Machines with either Taper- or Threaded-Nose Spindle

Convenient for holding wire, small rods, straight shank drills and mills. Hole extends through entire length. The cap nut forces spring collet against taper seat and closes chuck concentrically. Furnished with collet.

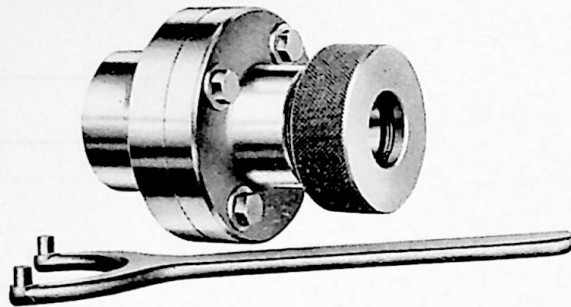


For Milling Machs., Milling Mach Attach. and Index Centers having B&S Taper Hole No.	Hole Through, Inches	Round Collet		Order by Number	Old Catalog Number
		No.	Size, Inches		
7	5/16	00	1/4	788-150	150
9	1/2	00	5/16	788-152	152
10	21/32	10	3/8	788-154	154
11	3/4	21	5/8	788-156	156
12	1	21	5/8	788-158	158
14	1	21	5/8	788-160	160

For Prices, See Separate Section

No. 350 Spring Chuck

For use on No. 1 Universal Grinding Machines and No. 13 Universal and Tool Grinding Machines prior to Serial No. 6325



Spring Chuck No. 350 is designed especially for use in the tool room and, as it permits jobs to be centered individually, it is suited for very accurate work. Its handiness and the speed with which it can be loaded and unloaded also adapts it for repeated operations requiring the ordinary commercial tolerances. The chuck holds conveniently bushings, needle valves and similar pieces, as well as wire and long thin rods which can extend through the headstock.

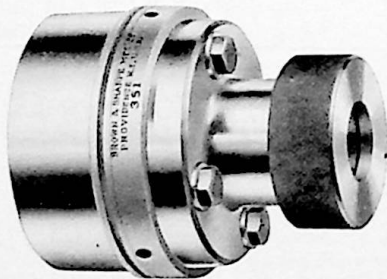
This Spring Chuck is made in two sections, the collet holder and the holder plate which is threaded to fit the headstock spindle of the machine. A No. 11G Spring Collet is held in place in the collet holder by a knurled nut that forces it against a tapered seat. This closes the collet concentrically. The collet holder is bolted to the holder plate by four cap screws, and, as the holes in the collet holder through which the cap screws pass are larger than the bodies of the cap screws, the collet holder can be adjusted readily so that work can be centered accurately in the machine.

A spanner wrench is furnished to tighten the holder plate securely on spindle. No. 11G Spring Collets are furnished separately, and listed below.

Order by Number 788-350

No. 351 Spring Chuck

For use on No. 13 Universal and Tool Grinding Machines commencing with Serial No. 6325



No. 351 Chuck is generally similar to Spring Chuck No. 350 described above. Conveniently holds bushings, needle valves and similar pieces, as well as wire and long thin rods. Spring Collet No. 11G used with chuck is held in place by a knurled nut that forces collet against tapered seat.

Made in two sections. Collet holder is bolted to plate by four cap screws which permit adjustments so that work can be centered accurately. Plate is tightened securely on spindle by pin wrench.

No. 11G Spring Collets are furnished separately, and listed at right.

Order by Number 788-351

No. 11G Spring Collets

Round

Size, Inches	Order by Number	Size, Inches	Order by Number
$\frac{1}{16}$	710-1004-311	$\frac{11}{32}$	710-1022-311
$\frac{5}{64}$	710-1005-311	$\frac{23}{64}$	710-1023-311
$\frac{3}{32}$	710-1006-311	$\frac{3}{8}$	710-1024-311
$\frac{7}{64}$	710-1007-311	$\frac{25}{64}$	710-1025-311
$\frac{1}{8}$	710-1008-311	$\frac{13}{32}$	710-1026-311
$\frac{9}{64}$	710-1009-311	$\frac{27}{64}$	710-1027-311
$\frac{5}{32}$	710-1010-311	$\frac{7}{16}$	710-1028-311
$\frac{11}{64}$	710-1011-311	$\frac{29}{64}$	710-1029-311
$\frac{3}{16}$	710-1012-311	$\frac{15}{32}$	710-1030-311
$\frac{13}{64}$	710-1013-311	$\frac{1}{2}$	710-1032-311
$\frac{7}{32}$	710-1014-311	$\frac{17}{32}$	710-1034-311
$\frac{15}{64}$	710-1015-311	$\frac{9}{16}$	710-1036-311
$\frac{1}{4}$	710-1016-311	$\frac{19}{32}$	710-1038-311
$\frac{17}{64}$	710-1017-311	$\frac{5}{8}$	710-1040-311
$\frac{9}{32}$	710-1018-311	$\frac{11}{16}$	710-1044-311
$\frac{19}{64}$	710-1019-311	$\frac{3}{4}$	710-1048-311
$\frac{5}{16}$	710-1020-311	$\frac{13}{16}$	710-1052-311
$\frac{21}{64}$	710-1021-311		

For Prices, See Separate Section

The products shown on pages 65 to 69 are fully described in our complete Small Tools Catalog No. 35 sent upon request. Individual catalogs or circulars describing this equipment are available also.



Brown & Sharpe Machinists' Tools are accurate, reliable and durable. These tools are made by skilled workmen, of the finest materials, of designs proven most practical for the work for which the tools are intended. Many years of research have resulted in a large variety of special equipment which we use in the manufacture and inspection of these

tools. The maintenance of a gage laboratory plays an important part in protecting their accuracy.

Brown & Sharpe Tools are available in a wide range of styles and sizes that cover practically every machine shop requirement:

Micrometers
Rules
Protractors
Bevels

Straight Edges
Squares
Vernier Tools
Gages

Indicators
V Blocks
Toolmakers' Tools
Calipers and Dividers

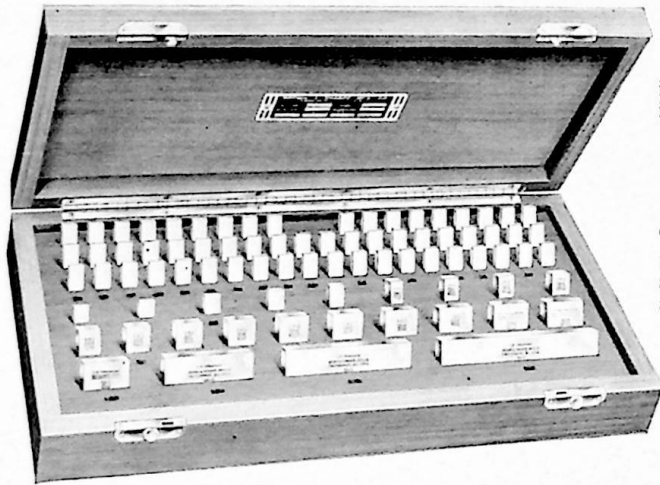
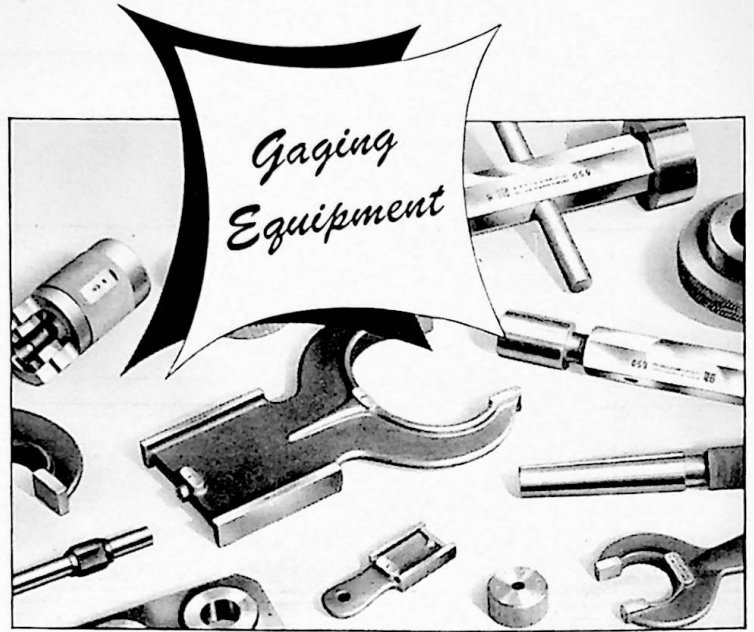
Cylindrical Plug Gages and Ring Gages

Furnished to American Gage Design Standard in complete range of sizes, both single and double end and in progressive and long types. Plug gages can be furnished with Pilot feature.

Standard Caliper Gages

Available in sizes from $\frac{1}{4}$ " to 4". These gages are strong and light and very convenient for everyday use.

Taper and other special gages are furnished to order. A gage laboratory, carefully maintained as to temperature and humidity, is devoted exclusively to gage production.



Johansson Gage Blocks

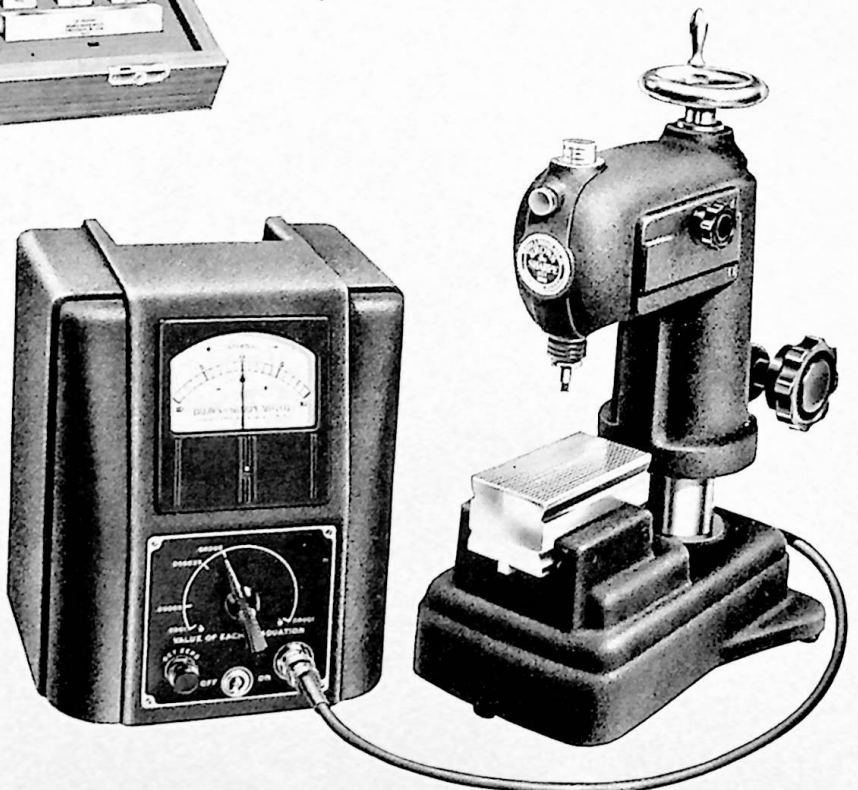
Johansson Gage Blocks and Accessories are manufactured in complete range of sizes and in sets. These blocks are made in three classes or standards with the following limits per inch:

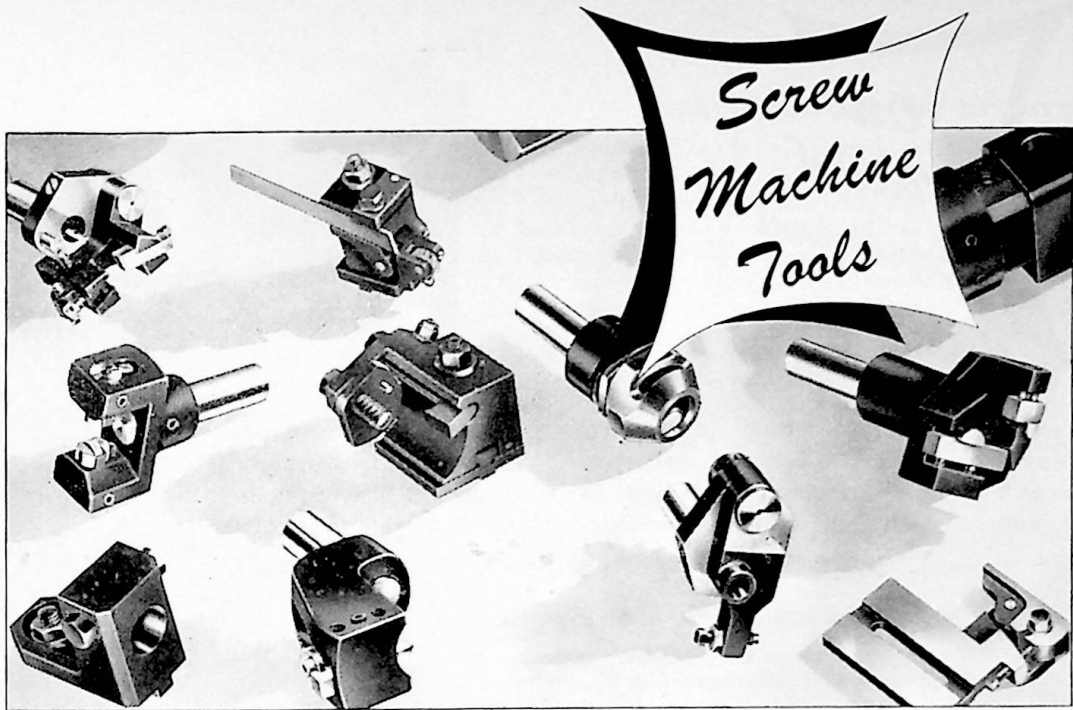
Class	
B	$\pm .000008"$
A	$\pm .000004"$
AA	$\pm .000002"$

These precision blocks are practically a necessity for maintaining master laboratory standards, periodic verification of work standards and as working gages in toolrooms and for layout and setup work. They are vital to quality control.

Electronic Production Measuring and Inspecting Equipment

This equipment through electronic means provides readings of from $.0001"$ to $.00001"$. Various features characterize Brown & Sharpe design—readings unaffected by heat—one master only for setting—true linear response and readings even for finest increments indicated by widely spaced graduations. Available for both external and internal measurements and for incorporation into special gages, fixtures and sorting devices. Special gaging fixtures made to order.

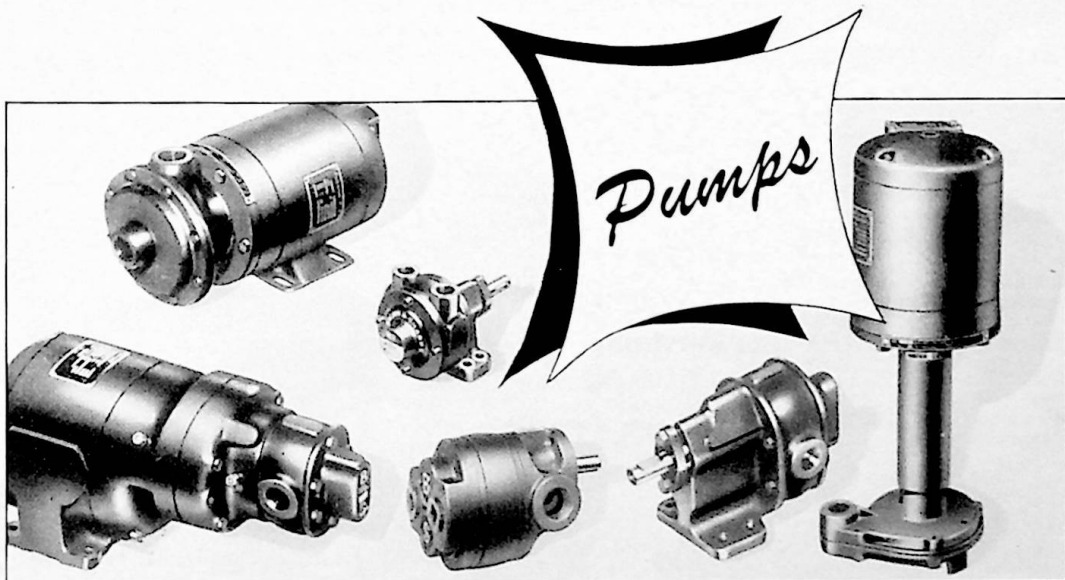




Provide maximum production, reliable performance accurate work and good finish. We are not only a manufacturer but an extensive user of these tools with an experience that results in superior screw machine tool design and performance.

The line includes Spring Collets, Feeding Fingers, Hollow Mills, Box Tools, Balance Turning Tools, Floating Holders,

Die, Tap and Drill Holders, Tool Posts for Circular and Square Tools, Cutting-Off Tool Posts, Angular Cutting-Off, Knee, Centering and Facing, Recessing, Knurling and Swing Tools, Fixed and Adjustable Guides and others—there's a tool for every requirement. Also, we maintain a special cam service for furnishing accurate and economically-designed cams.



Available in a complete line of geared, vane, centrifugal and motor driven types—Geared pumps in a wide range of capacities for handling oil and coolant and transfer purposes as well as for hydraulic installations—Vane pumps with advantages of automatic reversing and maintenance of delivery direction,

available in regular and stripped models for operation against pressures up to 100 lbs. per square inch—Motor Driven Centrifugal pumps for submergence in liquid and compact types for machine mounting for supplying coolant. There is a Brown & Sharpe pump to meet nearly every need.

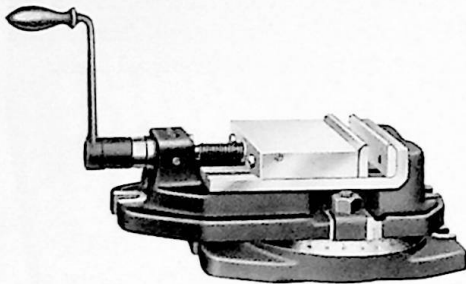


In addition to the different classes of products listed in this catalog, there also is a wide variety of other Brown & Sharpe Products listed here as Useful Equipment which finds extensive employ-

ment in simplifying machine work and protecting its accuracy. This Useful Equipment has characteristic Brown & Sharpe superior design and accuracy and serves a wide range of shop needs.

Ground Flat Stock

Available in three types: combination Oil or Water Hardening, Oil Hardening, and Water Hardening. 145 different sizes, in 18" lengths. The combination Oil or Water Hardening stock is furnished in thicknesses up to and including $\frac{3}{16}$ " and hardens in either oil or water, an exclusive Brown & Sharpe advantage. It eliminates the necessity and expense of keeping two types of stock on hand. The Oil Hardening and Water Hardening types are furnished in thicknesses from $\frac{1}{32}$ " to 1".



Vises

Long lived, rigidly constructed, strong holding tools. Parts are proportioned carefully for uniform strength. Designs give solid support to withstand the pressure of the cut, even at extreme ends of jaws. Plain, Flanged, Swivel, Tool-makers', Cam and Adjustable types.

Permanent Magnet Chucks

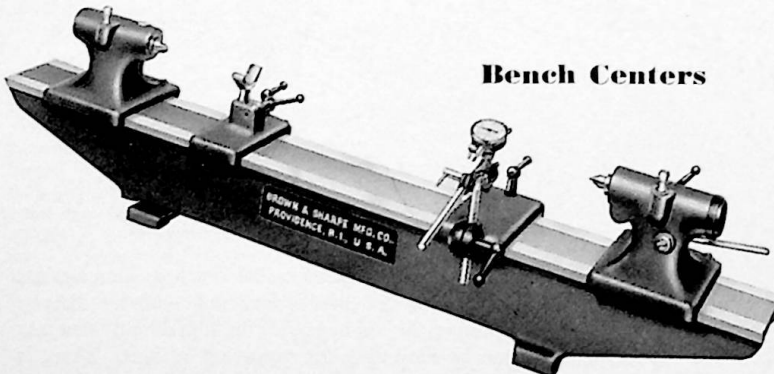
These chucks have the unique advantage of not requiring electric current—electrical connections, switches and auxiliary generators are eliminated. Chucks do not heat under any conditions and work can be held on them as long as desired.

Eight rectangular models varying in size from $2\frac{1}{16}$ " x $5\frac{1}{4}$ " to $12\frac{1}{8}$ " x 36". Three rotary models 5", 7" and $9\frac{1}{4}$ " in diameter.

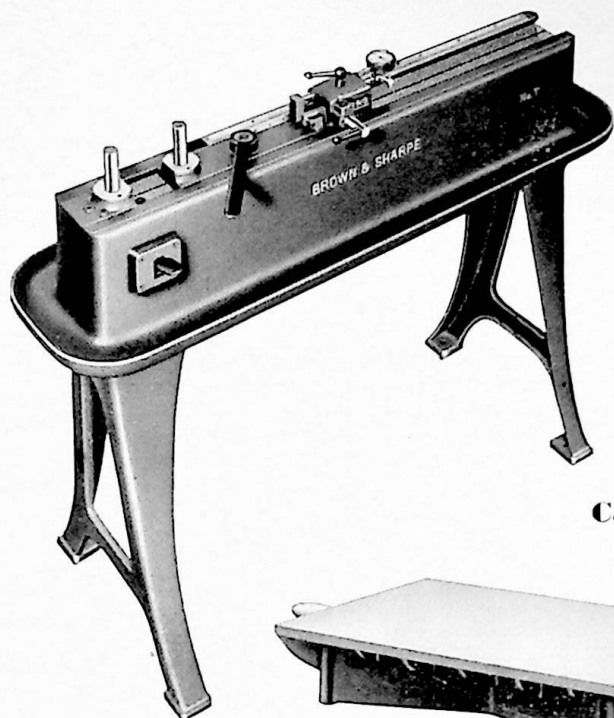
For sale only in the United States of America and its Territories.



Bench Centers



Provide simple, accurate means for holding cylindrical work for inspection purposes. Dial gage regularly reads by thousandths but a gage for ten-thousandths can be furnished. Centers swing 8" in diameter and take work 36" in length.

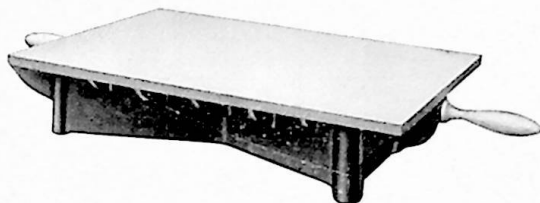


Spur Gear Testing Fixture

Provides for rapid and accurate testing of spur gears. Two different tests can be made; one with gears at a fixed center distance; the other, with gears held in mesh under pressure. Center distances are set accurately from 2" to 29½" in thousandths of an inch and a dial indicator shows run-out and variations of gears in thousandths of an inch as well as other common errors, and enables their identification.

A cam releasing device releases pressure between the gears and facilitates their removal; a lever arrangement unseats quickly the tapered studs on which gears are mounted.

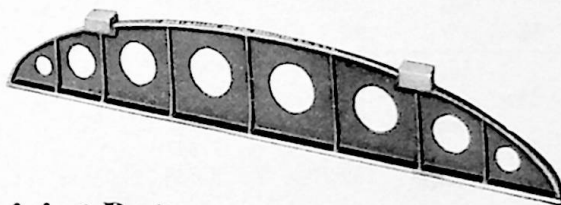
Cast Iron Surface Plates



Provide true surfaces for reference purposes. Iron is uniformly hard with no soft spots to plague users as with material where texture cannot be controlled. Special scraping pattern provides smooth bearing areas and low surface friction. Fifty-two sizes from 3½" x 4" to 42" x 42".

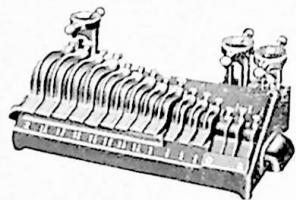
Cast Iron Straight Edges

Deep I beam cross section provides great strength. Vertical ribs further stiffen the web. Wooden blocks are provided for hand grips to prevent distortion from the effect of heat from workmen's hands. Twelve sizes from 18" x 1½" to 180" x 3½".



Work Driving Dogs

For use on grinding machines. Furnished individually and in sets. These dogs are sturdy and well balanced. Made of malleable iron with smooth japan finish. Clamp screws are hardened steel. For work from ⅛" to 4" diameter.



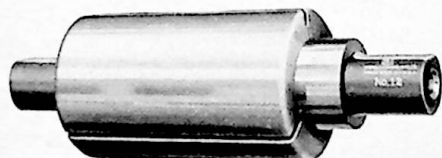
Index Plates

For use on Brown & Sharpe Universal, Universal Spiral, Plain and Triple Index Centers.

Taper Mandrels and Expansion Bushings

Mandrels are furnished in eleven sizes from .3125" to 1.75" diameter at small end.

Bushings are cast iron and capable of expanding .005" to .007". Forty-seven sizes from ½" to 3⅜" outside diameter.



Lathe Mandrels

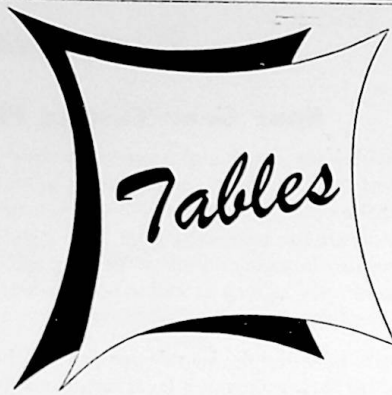
Tool steel, hardened and ground accurately. Tapered .0005" to an inch. Thirty-eight sizes from ⅜" to 3" diameter.



Publications

We issue the following publications: "Practical Treatise on Milling and Milling Machines"; "Construction and Use of Automatic Screw Machines"; "Set-up and Operation of

Brown & Sharpe Automatic Screw Machines"; and "Brown & Sharpe Handbook."



Decimal and Millimeter Equivalents of Fractional Parts of an Inch

Inches	Inches	Mm.	Inches	Inches	Mm.	Inches	Inches	Mm.
$\frac{1}{64}$	.01563	.397	$\frac{11}{32}$	.34375	8.731	$\frac{43}{64}$	.67188	17.065
$\frac{1}{32}$	.03125	.794	$\frac{23}{64}$	.35938	9.128	$\frac{11}{16}$	.6875	17.462
$\frac{3}{64}$	.04688	1.191	$\frac{3}{8}$	.375	9.525	$\frac{45}{64}$	.70313	17.859
$\frac{1}{16}$	.0625	1.587	$\frac{25}{64}$	.39063	9.922	$\frac{23}{32}$	.71875	18.256
$\frac{5}{64}$	.07813	1.984	$\frac{13}{32}$	.40625	10.319	$\frac{47}{64}$	.73438	18.653
$\frac{3}{32}$	.09375	2.381	$\frac{27}{64}$	.42188	10.716	$\frac{3}{4}$	.75	19.050
$\frac{7}{64}$	.10938	2.778	$\frac{7}{16}$	.4375	11.113	$\frac{49}{64}$	.76563	19.447
$\frac{1}{8}$	.125	3.175	$\frac{29}{64}$	.45313	11.509	$\frac{25}{32}$	.78125	19.844
$\frac{9}{64}$	.14063	3.572	$\frac{15}{32}$	.46875	11.906	$\frac{51}{64}$	.79688	20.240
$\frac{5}{32}$	.15625	3.969	$\frac{31}{64}$	.48438	12.303	$\frac{13}{16}$	.8125	20.637
$\frac{11}{64}$	.17188	4.366	$\frac{1}{2}$	.5	12.700	$\frac{53}{64}$	.82813	21.034
$\frac{3}{16}$	.1875	4.762	$\frac{33}{64}$	.51563	13.097	$\frac{27}{32}$	.84375	21.431
$\frac{13}{64}$	.20313	5.159	$\frac{17}{32}$	.53125	13.494	$\frac{55}{64}$	.85938	21.828
$\frac{7}{32}$	.21875	5.556	$\frac{35}{64}$	.54688	13.890	$\frac{7}{8}$	.875	22.225
$\frac{15}{64}$	.23438	5.953	$\frac{9}{16}$	.5625	14.287	$\frac{57}{64}$	.89063	22.622
$\frac{1}{4}$	.25	6.350	$\frac{37}{64}$	.57813	14.684	$\frac{29}{32}$	.90625	23.019
$\frac{17}{64}$	.26563	6.747	$\frac{19}{32}$	.59375	15.081	$\frac{59}{64}$	.92188	23.415
$\frac{9}{32}$	.28125	7.144	$\frac{39}{64}$	.60938	15.478	$\frac{15}{16}$	.9375	23.812
$\frac{19}{64}$	.29688	7.541	$\frac{5}{8}$	.625	15.875	$\frac{61}{64}$	.95313	24.209
$\frac{5}{16}$	.3125	7.937	$\frac{41}{64}$	.64063	16.272	$\frac{31}{32}$	.96875	24.606
$\frac{21}{64}$	.32813	8.334	$\frac{21}{32}$	.65625	16.669	$\frac{63}{64}$	.98438	25.003
						1	1.00000	25.400

Decimal Inch Equivalents of Millimeters and Fractional Parts of Millimeters

Mm.	Inches	Mm.	Inches	Mm.	Inches	Mm.	Inches	Mm.	Inches
1/100 =	.00039	26/100 =	.01024	51/100 =	.02008	76/100 =	.02992	2 =	.07874
2/100 =	.00079	27/100 =	.01063	52/100 =	.02047	77/100 =	.03032	3 =	.11811
3/100 =	.00118	28/100 =	.01102	53/100 =	.02087	78/100 =	.03071	4 =	.12748
4/100 =	.00157	29/100 =	.01142	54/100 =	.02126	79/100 =	.03110	5 =	.15685
5/100 =	.00197	30/100 =	.01181	55/100 =	.02165	80/100 =	.03150	6 =	.23622
6/100 =	.00236	31/100 =	.01220	56/100 =	.02205	81/100 =	.03189	7 =	.27559
7/100 =	.00276	32/100 =	.01260	57/100 =	.02244	82/100 =	.03228	8 =	.31496
8/100 =	.00315	33/100 =	.01299	58/100 =	.02283	83/100 =	.03268	9 =	.35433
9/100 =	.00354	34/100 =	.01339	59/100 =	.02323	84/100 =	.03307	10 =	.39370
10/100 =	.00394	35/100 =	.01378	60/100 =	.02362	85/100 =	.03346	11 =	.43307
11/100 =	.00433	36/100 =	.01417	61/100 =	.02402	86/100 =	.03386	12 =	.47244
12/100 =	.00472	37/100 =	.01457	62/100 =	.02441	87/100 =	.03425	13 =	.51181
13/100 =	.00512	38/100 =	.01496	63/100 =	.02480	88/100 =	.03465	14 =	.55118
14/100 =	.00551	39/100 =	.01535	64/100 =	.02520	89/100 =	.03504	15 =	.59055
15/100 =	.00591	40/100 =	.01575	65/100 =	.02559	90/100 =	.03543	16 =	.62992
16/100 =	.00630	41/100 =	.01614	66/100 =	.02598	91/100 =	.03583	17 =	.66929
17/100 =	.00669	42/100 =	.01654	67/100 =	.02638	92/100 =	.03622	18 =	.70866
18/100 =	.00709	43/100 =	.01693	68/100 =	.02677	93/100 =	.03661	19 =	.74803
19/100 =	.00748	44/100 =	.01732	69/100 =	.02717	94/100 =	.03701	20 =	.78740
20/100 =	.00787	45/100 =	.01772	70/100 =	.02756	95/100 =	.03740	21 =	.82677
21/100 =	.00827	46/100 =	.01811	71/100 =	.02795	96/100 =	.03780	22 =	.86614
22/100 =	.00866	47/100 =	.01850	72/100 =	.02835	97/100 =	.03819	23 =	.90551
23/100 =	.00906	48/100 =	.01890	73/100 =	.02874	98/100 =	.03858	24 =	.94488
24/100 =	.00945	49/100 =	.01929	74/100 =	.02913	99/100 =	.03898	25 =	.98425
25/100 =	.00984	50/100 =	.01969	75/100 =	.02953	1	.03937	26 =	1.02362

Metric Measures

In accordance with the standard practice approved by the American Standards Association, the ratio 25.4 mm = 1 inch is used for converting millimeters to inches. This factor varies only two millionths of an inch from the more exact factor 25.40005 mm, a difference so small as to be negligible for industrial length measurements.

The metric unit of length is the meter = 39.37 inches.

The metric unit of weight is the gram = 15.432 grains.

The following prefixes are used for sub-divisions and multiples: Milli = $\frac{1}{1000}$, Centi = $\frac{1}{100}$, Deci = $\frac{1}{10}$, Deca = 10, Hecto = 100, Kilo = 1000, Myria = 10,000.

Metric and English Equivalent Measures

Measures of Length

<i>Metric</i>	<i>English</i>
1 meter	= 39.37 inches, or 3.28083 feet, or 1.09361 yards
.3048 meter	= 1 foot
1 centimeter	= .3937 inch
2.54 centimeters	= 1 inch
1 millimeter	= .03937 inch, or nearly $\frac{1}{25}$ inch
25.4 millimeters	= 1 inch
1 kilometer	= 1093.61 yards, or 0.62137 mile

Measures of Capacity

<i>Metric</i>	<i>English</i>
1 liter (= 1 cubic decimeter)	= { 61.023 cubic inches .03531 cubic foot .2642 gal. (American) 2.202 lbs. of water at 62°F.
28.317 liters	= 1 cubic foot
3.785 liters	= 1 gallon (American)
4.543 liters	= 1 gallon (Imperial)

Measures of Weight

<i>Metric</i>	<i>English</i>
1 gram	= 15.432 grains
.0648 gram	= 1 grain
28.35 grams	= 1 ounce avoirdupois
1 kilogram	= 2.2046 pounds
.4536 kilogram	= 1 pound
1 metric ton	} = { .9842 ton of 2240 pounds 19.68 cwt.
1000 kilograms		= 2204.6 pounds
1.016 metric tons	} = 1 ton of 2240 pounds
1016 kilograms	

Useful Information

To find the circumference of a circle, multiply the diameter by 3.1416.

To find the diameter of a circle, multiply the circumference by .31831.

To find the area of a circle, multiply the square of the diameter by .7854.

The radius of a circle \times 6.283185 = the circumference.

The square of the circumference of a circle \times .07958 = the area.

Half the circumference of a circle \times half its diameter = the area.

The circumference of a circle \times .159155 = the radius.

The square root of the area of a circle \times .56419 = the radius.

The square root of the area of a circle \times 1.12838 = the diameter.

To find the diameter of a circle equal in area to a given square, multiply a side of the square by 1.12838.

To find the side of a square equal in area to a given circle, multiply the diameter by .8862.

To find the side of a square inscribed in a circle, multiply the diameter by .7071.

To find the side of a hexagon inscribed in a circle, multiply the diameter of the circle by .500.

To find the diameter of a circle inscribed in a hexagon, multiply a side of the hexagon by 1.7321.

To find the side of an equilateral triangle inscribed in a circle, multiply the diameter of the circle by .866.

To find the diameter of a circle inscribed in an equilateral triangle, multiply a side of the triangle by .57735.

To find the area of the surface of a ball (sphere), multiply the square of the diameter by 3.1416.

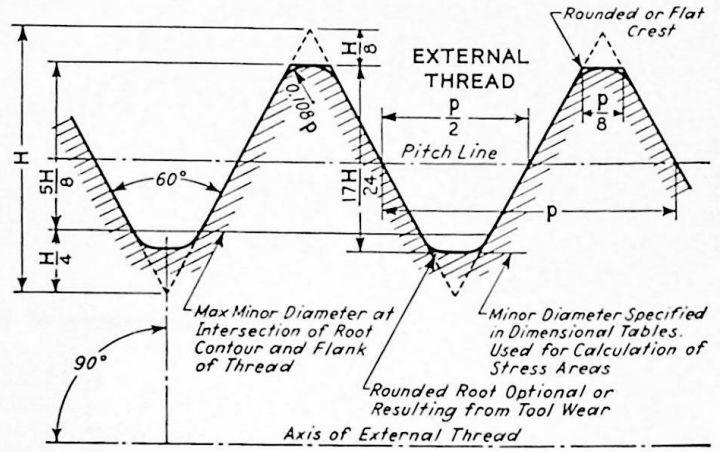
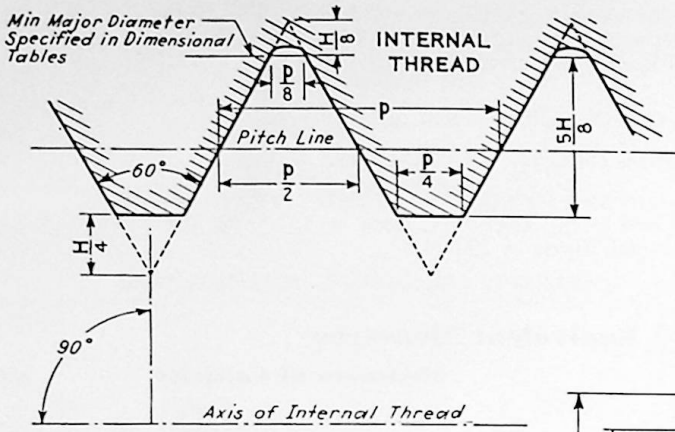
To find the volume of a ball (sphere), multiply the cube of the diameter by .5236.

Doubling the diameter of a pipe increases its capacity four times.

To find the pressure in pounds per square inch at the base of a column of water, multiply the height of the column in feet by .433.

A gallon of water (U. S. Standard) weighs 8.336 pounds and contains 231 cubic inches. A cubic foot of water contains 7 $\frac{1}{2}$ gallons, 1728 cubic inches, and weighs 62.425 pounds at a temperature of about 39° F. These weights change slightly above and below this temperature.

Unified and American Form Threads Tap Drill Sizes



$p = \text{pitch} = \frac{1}{\text{No. of threads per inch}}$
 $n = \text{Number of threads per inch}$
 $H = \text{Height of sharp V thread} = \text{pitch} \times .86603 = \frac{.86603}{n}$

Minor diameter of external thread = Nominal Diameter - $\frac{1.22687}{n}$

Minor diameter of internal thread = Nominal Diameter - $\frac{1.08253}{n}$

Tap Drill size is approximately 75% thread size

Nominal Size	Pitch Series	Major Diameter, Inches	Pitch Diameter, Inches	Tap Drill Size, Approx. 75% Thread	Decimal Equivalent, Tap Drill	Nominal Size	Pitch Series	Major Diameter, Inches	Pitch Diameter, Inches	Tap Drill Size, Approx. 75% Thread	Decimal Equivalent, Tap Drill
0-80	NF	.0600	.0519	$\frac{3}{64}$	.0469	10-24	NC-UNC	.1900	.1629	25	.1495
1-56	NS	.0730	.0614	51	.0550	28	NS	.1900	.1668	23	.1510
64	NC	.0730	.0629	53	.0595	30	NS	.1900	.1684	22	.1570
72	NF	.0730	.0640	53	.0595	32	NF-UNF	.1900	.1697	21	.1590
2-56	NC	.0860	.0744	50	.0700	12-24	NC	.2160	.1889	16	.1770
64	NF	.0860	.0759	50	.0700	28	NF	.2160	.1928	14	.1820
3-48	NC	.0990	.0855	47	.0785	32	NEF	.2160	.1957	13	.1850
56	NF	.0990	.0874	45	.0820	14-20	NS	.2420	.2095	10	.1935
4-32	NS	.1120	.0917	45	.0820	24	NS	.2420	.2149	7	.2010
36	NS	.1120	.0940	44	.0860	$\frac{1}{16}$ -64	NS	.0625	.0524	$\frac{3}{64}$	.0469
40	NC-UNC	.1120	.0958	43	.0890	$\frac{3}{32}$ -48	NS	.0938	.0803	49	.0730
48	NF	.1120	.0985	42	.0935	50	NS	.0938	.0808	49	.0730
5-36	NS	.1250	.1070	40	.0980	$\frac{1}{8}$ -40	NS	.1250	.1088	38	.1015
40	NC	.1250	.1088	38	.1015	$\frac{5}{32}$ -32	NS	.1563	.1360	$\frac{1}{8}$	.1250
44	NF	.1250	.1102	37	.1040	36	NS	.1563	.1382	30	.1285
6-32	NC-UNC	.1380	.1177	36	.1065	$\frac{3}{16}$ -24	NS	.1875	.1604	26	.1470
36	NS	.1380	.1200	34	.1110	32	NS	.1875	.1672	22	.1570
40	NF	.1380	.1218	33	.1130	$\frac{1}{2}$ -24	NS	.2188	.1917	16	.1770
8-30	NS	.1640	.1423	30	.1285	32	NS	.2188	.1985	12	.1890
32	NC-UNC	.1640	.1437	29	.1360	$\frac{1}{4}$ -20	NC-UNC	.2500	.2175	7	.2010
36	NF	.1640	.1460	29	.1360	24	NS	.2500	.2229	4	.2090
40	NS	.1640	.1478	28	.1405	27	NS	.2500	.2260	3	.2130
						28	NF-UNF	.2500	.2268	3	.2130
						32	NEF	.2500	.2297	$\frac{1}{32}$	.2188

Unified and American Form Threads (Continued)
Tap Drill Sizes

Tap Drill size
is approximately 75% thread size

Nominal Size	Pitch Series	Major Diameter, Inches	Pitch Diameter, Inches	Tap Drill Size, Approx. 75% Thread	Decimal Equivalent, Tap Drill
5/16-18	NC-UNC	.3125	.2764	F	.2570
20	NS	.3125	.2800	1 7/64	.2656
24	NF-UNF	.3125	.2854	I	.2720
27	NS	.3125	.2884	J	.2770
32	NEF	.3125	.2922	9/32	.2812
3/8-16	NC-UNC	.3750	.3344	5/16	.3125
20	NS	.3750	.3425	21/64	.3281
24	NF-UNF	.3750	.3479	Q	.3320
27	NS	.3750	.3509	R	.3390
32	NEF	.3750	.3547	11/32	.3438
7/16-14	NC-UNC	.4375	.3911	U	.3680
20	NF-UNF	.4375	.4050	25/64	.3906
24	NS	.4375	.4104	X	.3970
27	NS	.4375	.4134	Y	.4040
28	NEF-UNEF	.4375	.4143	Y	.4040
1/2-12	N	.5000	.4459	27/64	.4219
13	NC-UNC	.5000	.4500	27/64	.4219
20	NF-UNF	.5000	.4675	27/64	.4531
24	NS	.5000	.4729	29/64	.4531
27	NS	.5000	.4759	15/32	.4687
28	NEF-UNEF	.5000	.4768	15/32	.4688
9/16-12	NC-UNC	.5625	.5084	31/64	.4844
18	NF-UNF	.5625	.5264	33/64	.5156
24	NEF	.5625	.5354	33/64	.5156
27	NS	.5625	.5384	17/32	.5312
5/8-11	NC-UNC	.6250	.5660	17/32	.5312
12	N	.6250	.5709	35/64	.5469
18	NF-UNF	.6250	.5889	37/64	.5781
24	NEF	.6250	.5979	37/64	.5781
27	NS	.6250	.6009	19/32	.5937
11/16-11	NS	.6875	.6285	19/32	.5937
16	NS	.6875	.6169	5/8	.6250
24	NEF	.6875	.6604	41/64	.6406
3/4-10	NC-UNC	.7500	.6850	21/32	.6562
12	N	.7500	.6959	43/64	.6719
16	NF-UNF	.7500	.7094	11/16	.6875
20	NEF-UNEF	.7500	.7175	45/64	.7031
27	NS	.7500	.7259	23/32	.7187
13/16-10	NS	.8125	.7476	23/32	.7187
20	NEF-UNEF	.8125	.7800	49/64	.7656
7/8-9	NC-UNC	.8750	.8028	49/64	.7656
12	N	.8750	.8209	51/64	.7969
14	NF-UNF	.8750	.8286	13/16	.8125
18	NS	.8750	.8389	53/64	.8281
20	NEF-UNEF	.8750	.8425	53/64	.8281
27	NS	.8750	.8509	27/32	.8437
15/16-9	NS	.9375	.8654	53/64	.8281
20	NEF-UNEF	.9375	.9050	57/64	.8906
1-8	NC-UNC	1.0000	.9188	7/8	.8750
12	NF-UNF	1.0000	.9459	59/64	.9219
14	NS	1.0000	.9536	15/16	.9375
20	NEF-UNEF	1.0000	.9675	61/64	.9531
27	NS	1.0000	.9759	31/32	.9687
1 1/16-18	NEF	1.0625	1.0264	11/64	1.0156
1 1/8-7	NC-UNC	1.1250	1.0322	63/64	.9844
12	NF-UNF	1.1250	1.0709	13/64	1.0469
18	NEF	1.1250	1.0889	13/64	1.0781
1 3/16-18	NEF	1.1875	1.1514	19/64	1.1406

Tap Drill size
is approximately 75% thread size

Nominal Size	Pitch Series	Major Diameter, Inches	Pitch Diameter, Inches	Tap Drill Size, Approx. 75% Thread	Decimal Equivalent, Tap Drill
1 1/4-7	NC-UNC	1.2500	1.1572	17/64	1.1094
12	NF-UNF	1.2500	1.1959	111/64	1.1719
18	NEF	1.2500	1.2139	113/64	1.2031
1 1/2-18	NEF	1.3125	1.2764	117/64	1.2656
1 3/8-6	NC-UNC	1.3750	1.2667	17/32	1.2187
12	NF-UNF	1.3750	1.3209	119/64	1.2969
18	NEF	1.3750	1.3389	121/64	1.3281
1 1/2-18	NEF	1.4375	1.4014	125/64	1.3906
1 1/2-6	NC-UNC	1.5000	1.3917	111/32	1.3437
12	NF-UNF	1.5000	1.4459	127/64	1.4219
18	NEF	1.5000	1.4639	129/64	1.4531
1 1/2-18	NEF	1.5625	1.5264	133/64	1.5156
1 5/8-5 1/2	NS	1.6250	1.5069	129/64	1.4531
18	NEF	1.6250	1.5889	137/64	1.5781
1 1/2-18	NEF	1.6875	1.6514	141/64	1.6406
1 3/4-5	NC-UNC	1.7500	1.6201	119/16	1.5625
16	NEF-UNEF	1.7500	1.7094	145/64	1.6875
1 7/8-5	NS	1.8750	1.7451	149/64	1.6875
2-4 1/2	NC-UNC	2.0000	1.8557	123/32	1.7812
16	NEF-UNEF	2.0000	1.9594	153/64	1.9375
2 1/8-4 1/2	NS	2.1250	1.9807	129/32	1.9062
2 1/4-4 1/2	NC-UNC	2.2500	2.1057	21/32	2.0312
2 3/8-4	NS	2.3750	2.2126	21/8	2.1250
2 1/2-4	NC-UNC	2.5000	2.3376	21/4	2.2500
2 3/4-4	NC-UNC	2.7500	2.5876	21/2	2.5000
3-4	NC-UNC	3.0000	2.8376	23/4	2.7500
3 1/4-4	NC-UNC	3.2500	3.0876	3	3.0000
3 1/2-4	NC-UNC	3.5000	3.3376	3 1/4	3.2500
3 3/4-4	NC-UNC	3.7500	3.5876	3 1/2	3.5000
4-4	NC-UNC	4.0000	3.8376	3 3/4	3.7500

American National Pipe Threads
Tap Drill Sizes

Sizes of Pipe, Inches	Number of Threads per Inch	Root Diameter Small End of Pipe and Gage, Inches	Tap Drill	
			Size	Decimal Equivalent
1/8	27	.3339	R	.339
1/4	18	.4329	7/16	.437
3/8	18	.5676	31/64	.578
1/2	14	.7013	23/32	.719
3/4	14	.9105	39/64	.921
1	11 1/2	1.1441	15/32	1.156
1 1/4	11 1/2	1.4876	11 1/2	1.500
1 1/2	11 1/2	1.7265	1 5/8	1.734
2	11 1/2	2.1995	27/32	2.218
2 1/2	8	2.6195	2 5/8	2.625
3	8	3.2406	3 1/4	3.250
3 1/2	8	3.7375	3 3/4	3.750
4	8	4.2344	4 1/4	4.250

Allowances for Fits

The allowances given in the tables below have been found useful in the manufacture of machine parts. For special cases,

it may be necessary to increase or decrease the allowances given in the tables.

Running Fits

Diameter, Inches	For Shafts with Speeds Under 600 R.P.M. Ordinary Working Conditions Allowances, Inches	For Shafts with Speeds Over 600 R.P.M. Heavy Pressure—Severe Working Conditions Allowances, Inches
Up to 1/2	-0.0005 to -0.001	-0.0005 to -0.001
1/2 to 1	-0.00075 to -0.0015	-0.001 to -0.002
1 to 2	-0.0015 to -0.0025	-0.002 to -0.003
2 to 3 1/2	-0.002 to -0.003	-0.002 to -0.004
3 1/2 to 6	-0.0025 to -0.004	-0.004 to -0.005

Standard Fits

Diameter, Inches	For Light Service where Part is Keyed to Shaft and Clamped Endwise—No Fitting Allowances, Inches	With Play Eliminated—Part Should Assemble Readily—Some Fitting and Selecting May be Required Allowances, Inches
Up to 1/2	Standard to -0.00025	Standard to +0.00025
1/2 to 3 1/2	Standard to -0.0005	Standard to +0.0005
3 1/2 to 6	Standard to -0.00075	Standard to +0.00075

Sliding Fits

Diameter, Inches	For Shafts with Gears, Clutches or Similar Parts which Must be Free to Slide Allowances, Inches
Up to 1/2	-0.0005 to -0.001
1/2 to 1	-0.00075 to -0.0015
1 to 2	-0.0015 to -0.0025
2 to 3 1/2	-0.002 to -0.003
3 1/2 to 6	-0.0025 to -0.004

Driving Fits

Diameter, Inches	For Permanent Assembly of Parts so Located that Driving Cannot be Done Readily Allowances, Inches	For Permanent Assembly and Severe Duty and where there is Ample Room for Driving Allowances, Inches
Up to 1/2	Standard to +0.00025	+0.0005 to +0.001
1/2 to 1	+0.00025 to +0.0005	+0.0005 to +0.001
1 to 2	+0.0005 to +0.00075	+0.0005 to +0.001
2 to 3 1/2	+0.0005 to +0.001	+0.00075 to +0.00125
3 1/2 to 6	+0.0005 to +0.001	+0.001 to +0.0015

Forced Fits

Diameter, Inches	For Permanent Assembly and very Severe Service—Hydraulic Press Used for Larger Parts Allowances, Inches
Up to 1/2	+0.00075 to +0.001
1/2 to 1	+0.001 to +0.002
1 to 2	+0.002 to +0.003
2 to 3 1/2	+0.003 to +0.004
3 1/2 to 6	+0.004 to +0.005

United States Standard Gage Sizes

For Sheet and Plate Iron and Steel

This is the recognized commercial standard for all uncoated sheet and plate iron and steel, and is the legal standard to be

used in determining duties and taxes levied by the United States, under act of Congress approved March 3, 1893.

No. of Gage	Approximate Thickness, Inches, (Fractions)	Approximate Thickness, Inches, (Decimals)	Weight per Sq. Ft., Ounces, Avoirdupois	Weight per Sq. Ft., Pounds, Avoirdupois	No. of Gage	Approximate Thickness, Inches, (Fractions)	Approximate Thickness, Inches, (Decimals)	Weight per Sq. Ft., Oz., Avoirdupois	Weight per Sq. Ft., Lbs., Avoirdupois
0000000	1/2	.5	320	20.00	17	9/160	.0563	36	2.25
000000	15/32	.4688	300	18.75	18	1/20	.05	32	2.
00000	7/16	.4375	280	17.50	19	7/160	.0438	28	1.75
0000	13/32	.4063	260	16.25	20	3/80	.0375	24	1.50
000	3/8	.375	240	15.00	21	11/320	.0344	22	1.375
00	11/32	.3438	220	13.75	22	1/32	.0313	20	1.25
0	5/16	.3125	200	12.50	23	9/320	.0281	18	1.125
1	9/32	.2813	180	11.25	24	1/40	.025	16	1.
2	17/64	.2656	170	10.625	25	7/320	.0219	14	.875
3	1/4	.25	160	10.00	26	3/160	.0188	12	.75
4	15/64	.2344	150	9.375	27	11/640	.0172	11	.6875
5	7/32	.2188	140	8.75	28	1/64	.0156	10	.625
6	13/64	.2031	130	8.125	29	9/640	.0141	9	.5625
7	3/16	.1875	120	7.5	30	1/80	.0125	8	.5
8	11/64	.1719	110	6.875	31	7/640	.0109	7	.4375
9	5/32	.1563	100	6.25	32	13/1280	.0102	6 1/2	.4063
10	9/64	.1406	90	5.625	33	3/320	.0094	6	.375
11	1/8	.125	80	5.00	34	11/1280	.0086	5 1/2	.3438
12	7/64	.1094	70	4.375	35	5/640	.0078	5	.3125
13	3/32	.0938	60	3.75	36	9/1280	.0070	4 1/2	.2813
14	5/64	.0781	50	3.125	37	17/2560	.0066	4 1/4	.2656
15	9/128	.0703	45	2.8125	38	1/160	.0063	4	.25
16	1/16	.0625	40	2.5					

Table of Cutting Speeds—Revolutions per Minute

Feet per Min.	DIAMETER, INCHES															
	1/16	1/8	3/16	1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
15	917	458	306	229	183	153	131	115	91.7	76.4	65.5	57.3	50.9	45.8	41.7	38.2
20	1222	611	407	306	244	204	175	153	122	102	87.3	76.4	67.9	61.1	55.6	50.9
25	1528	764	509	382	306	255	218	191	153	127	109	95.5	84.9	76.4	69.4	63.7
30	1833	917	611	458	367	306	262	229	183	153	131	115	102	91.7	83.3	76.4
40	2445	1222	815	611	489	407	349	306	244	204	175	153	136	122	111	102
50	3056	1528	1019	764	611	509	437	382	306	255	218	191	170	153	139	127
60	3667	1833	1222	917	733	611	524	458	367	306	262	229	204	183	167	153
70	4278	2139	1426	1070	856	713	611	535	428	357	306	267	238	214	194	178
80	4889	2445	1630	1222	978	815	698	611	489	407	349	306	272	244	222	204
90	5500	2750	1833	1375	1100	917	786	688	550	458	393	344	306	275	250	229
100	6112	3056	2037	1528	1222	1019	873	764	611	509	437	382	340	306	278	255
125	7639	3820	2546	1910	1528	1273	1091	955	764	637	546	477	424	382	347	318
150	9167	4584	3056	2292	1833	1528	1310	1146	917	764	655	573	509	458	417	382
175	.....	5348	3565	2674	2139	1783	1528	1337	1070	891	764	668	594	535	486	446
200	.....	6112	4074	3056	2445	2037	1746	1528	1222	1019	873	764	679	611	556	509
250	.....	7639	5098	3820	3056	2546	2183	1910	1528	1273	1091	955	849	764	694	637
300	.....	9167	6112	4584	3667	3056	2619	2292	1833	1528	1310	1146	1019	917	833	764
350	.....	.....	7130	5348	4278	3565	3056	2674	2139	1783	1528	1337	1188	1070	972	891
400	.....	.....	8149	6112	4889	4074	3492	3056	2445	2037	1746	1528	1358	1222	1111	1019
500	.....	.....	.....	7639	6112	5093	4365	3820	3056	2546	2183	1910	1698	1528	1389	1273
600	.....	.....	.....	9167	7334	6112	5238	4584	3667	3056	2619	2292	2037	1833	1667	1528
700	.....	.....	.....	.....	8556	7130	6112	5348	4278	3565	3056	2674	2377	2139	1945	1783
800	.....	.....	.....	.....	9778	8149	6985	6112	4889	4074	3492	3056	2716	2445	2222	2037
1000	.....	.....	.....	.....	.....	.....	8731	7639	6112	5093	4365	3820	3395	3056	2778	2546

Feet per Min.	DIAMETER, INCHES															
	1 5/8	1 3/4	1 7/8	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2	3 3/4	4	4 1/2	5	5 1/2	6
15	35.3	32.7	30.6	28.6	25.5	22.9	20.8	19.1	17.6	16.4	15.3	14.3	12.7	11.5	10.4	9.5
20	47.0	43.7	40.7	38.2	34.0	30.6	27.8	25.5	23.5	21.8	20.4	19.1	17.0	15.3	13.9	12.7
25	58.8	54.6	50.9	47.7	42.4	38.2	34.7	31.8	29.4	27.3	25.5	23.9	21.2	19.1	17.4	15.9
30	70.5	65.5	61.1	57.3	50.9	45.8	41.7	38.2	35.3	32.7	30.6	28.6	25.5	22.9	20.8	19.1
40	94.0	87.3	81.5	76.4	67.9	61.1	55.6	50.9	47.0	43.7	40.7	38.2	34.0	30.6	27.8	25.5
50	118	109	102	95.5	84.9	76.4	69.4	63.7	58.8	54.6	50.9	47.7	42.4	38.2	34.7	31.8
60	141	131	122	115	102	91.7	83.3	76.4	70.5	65.5	61.1	57.3	50.9	45.8	41.7	38.2
70	165	153	143	134	119	107	97.2	89.1	82.3	76.4	71.3	66.8	59.4	53.5	48.6	44.6
80	188	175	163	153	136	122	111	102	94.0	87.3	81.5	76.4	67.9	61.1	55.6	50.9
90	212	196	183	172	153	138	125	115	106	98.2	91.7	85.9	76.4	68.8	62.5	57.3
100	235	218	204	191	170	153	139	127	118	109	102	95.5	84.9	76.4	69.4	63.7
125	294	273	255	239	212	191	174	159	147	136	127	119	106	95.5	86.8	79.6
150	353	327	306	286	255	229	208	191	176	164	153	143	127	115	104	95.5
175	411	382	357	334	297	267	243	223	206	191	178	167	149	134	122	111
200	470	437	407	382	340	306	278	255	235	218	204	191	170	153	139	127
250	588	546	509	477	424	382	347	318	294	273	255	239	212	191	174	159
300	705	655	611	573	509	458	417	382	353	327	306	286	255	229	208	191
350	823	764	713	668	594	535	486	446	411	382	357	334	297	267	243	223
400	940	873	815	764	679	611	556	509	470	437	407	382	340	306	278	255
500	1175	1091	1019	955	849	764	694	637	588	546	509	477	424	382	347	318
600	1410	1310	1222	1146	1019	917	833	764	705	655	611	573	509	458	417	382
700	1645	1528	1426	1337	1188	1070	972	891	823	764	713	668	594	535	486	446
800	1880	1746	1630	1528	1358	1222	1111	1019	940	873	815	764	679	611	556	509
1000	2351	2183	2037	1910	1698	1528	1389	1273	1175	1091	1019	955	849	764	694	637

Feet per Min.	DIAMETER, INCHES															
	6 1/2	7	7 1/2	8	8 1/2	9	9 1/2	10	11	12	13	14	15	16	17	18
15	8.8	8.2	7.6	7.2	6.7	6.4	6.0	5.7	5.2	4.8	4.4	4.1	3.8	3.6	3.4	3.2
20	11.8	10.9	10.2	9.5	9.0	8.5	8.0	7.6	6.9	6.4	5.9	5.5	5.1	4.8	4.5	4.2
25	14.7	13.6	12.7	11.9	11.2	10.6	10.1	9.5	8.7	8.0	7.3	6.8	6.4	6.0	5.6	5.3
30	17.6	16.4	15.3	14.3	13.5	12.7	12.1	11.5	10.4	9.5	8.8	8.2	7.6	7.2	6.7	6.4
40	23.5	21.8	20.4	19.1	18.0	17.0	16.1	15.3	13.9	12.7	11.8	10.9	10.2	9.5	9.0	8.5
50	29.4	27.3	25.5	23.9	22.5	21.2	20.1	19.1	17.4	15.9	14.7	13.6	12.7	11.9	11.2	10.6
60	35.3	32.7	30.6	28.6	27.0	25.5	24.1	22.9	20.8	19.1	17.6	16.4	15.3	14.3	13.5	12.7
70	41.1	38.2	35.7	33.4	31.5	29.7	28.1	26.7	24.3	22.3	20.6	19.1	17.8	16.7	15.7	14.9
80	47.0	43.7	40.7	38.2	36.0	34.0	32.2	30.6	27.8	25.5	23.5	21.8	20.4	19.1	18.0	17.0
90	52.9	49.1	45.8	43.0	40.4	38.2	36.2	34.4	31.3	28.6	26.4	24.6	22.9	21.5	20.2	19.1
100	58.8	54.6	50.9	47.7	44.9	42.4	40.2	38.2	34.7	31.8	29.4	27.3	25.5	23.9	22.5	21.2
125	73.5	68.2	63.7	59.7	56.2	53.1	50.3	47.7	43.4	39.8	36.7	34.1	31.8	29.8	28.1	26.5
150	88.1	81.9	76.4	71.6	67.4	63.7	60.3	57.3	52.1	47.7	44.1	40.9	38.2	35.8	33.7	31.8
175	103	95.5	89.1	83.6	78.6	74.3	70.4	66.8	60.8	55.7	51.4	47.7	44.6	41.8	39.3	37.1
200	118	109	102	95.5	89.9	84.9	80.4	76.4	69.4	63.7	58.8	54.6	50.9	47.7	44.9	42.4
250	147	136	127	119	112	106	101	95.5	86.8	79.6	73.5	68.2	63.7	59.7	56.2	53.1
300	176	164	153	143	135	127	121	115	104	95.5	88.1	81.9	76.4	71.6	67.4	63.7
350	206	191	178	167	157	149	141	134	122	111	103	95.5	89.1	83.6	78.6	74.3
400	235	218	204	191	180	170	161	153	139	127	118	109	102	95.5	90.0	84.9
500	294	273	255	239	225	212	201	191	174	159	147	136	127	119	112	106
600	353	327	306	286	270	255	241	229	208	191	176	164	153	143	135	127
700	411	382	357	334	315	297	281	267	243	223	206	191	178	167	157	149
800	470	437	407	382	360	340	322	306	278	255	235	218	204	191	180	170
1000	588	546	509	477	449	424	402	382	347	318	294	273	255	239	225	212

Hardness Conversion Table for Nickel Alloy Steels (Approximate)

Brinell		Vickers Diam. Pyramid (50 Kg. Load)	Rockwell		Shore	Tensile Strength (x 1000 psi)	Brinell		Vickers Diam. Pyramid (50 Kg. Load)	Rockwell		Shore	Tensile Strength (x 1000 psi)
Dia. (mm.) 3000 Kg. 10mm. Carbide Ball	Hardness Number		C Scale 150 Kg. Brale	B Scale 100 Kg. 1/16" Ball			Dia. (mm.) 3000 Kg. 10mm. Carbide Ball	Hardness Number		C Scale 150 Kg. Brale	B Scale 100 Kg. 1/16" Ball		
....	767	880	66.5	.....	93	...	3 45	311	328	33	107.5	46	155
2 25	745	840	65.5	.....	91	...	3 50	302	319	32	107	45	150
2 30	712	784	64	.....	87	...	3 55	293	309	31	106	43	145
2 35	682	737	61.5	.....	84	...	3 60	285	301	30	105.5	42	141
2 40	653	697	60	.....	81	...	3 65	277	292	29	104.5	41	137
2 45	627	667	58.5	.....	79	323	3 70	269	284	27 5	104	40	133
2 50	601	640	57.5	.....	77	309	3 75	262	276	26 5	103	39	129
2 55	578	615	56	.....	75	297	3 80	255	269	25 5	102	38	126
2 60	555	591	54.5	.....	73	285	3 85	248	261	24	101	37	122
2 65	534	569	53.5	.....	71	274	3 90	241	253	23	100	36	118
2 70	514	547	52	.....	70	263	3 95	235	247	21 5	99	35	115
2 75	495	523	51	.....	68	253	4 00	229	241	20 5	98	34	111
2 80	477	508	49.5	.....	66	243	4 05	223	234	19	97	...	...
2 85	461	491	48.5	.....	65	235	4 10	217	228	17 5	96 5	33	105
2 90	444	472	47	.....	63	225	4 15	212	222	16	95 5	...	102
2 95	429	455	45.5	.....	61	217	4 20	207	218	15	94 5	32	100
3 00	415	440	44.5	.....	59	210	4 30	197	207	12 5	93	30	95
3 05	401	425	43	.....	58	202	4 40	187	196	10	90 5	...	90
3 10	388	410	42	.....	56	195	4 50	179	188	8	89	27	87
3 15	375	396	40.5	.....	54	188	4 60	170	178	5	87	26	83
3 20	363	383	39	.....	52	182	4 70	163	171	5	85	25	79
3 25	352	372	38	110	51	176	4 80	156	163	1	83	...	76
3 30	341	360	36.5	109	50	170	4 90	149	156	..	81	23	73
3 35	331	350	35.5	108.5	48	166	5 00	143	150	..	78.5	22	71
3 40	321	339	34.5	108	47	160	5 10	137	143	..	76.5	21	67

(Values in italics beyond normal range—for information only.)

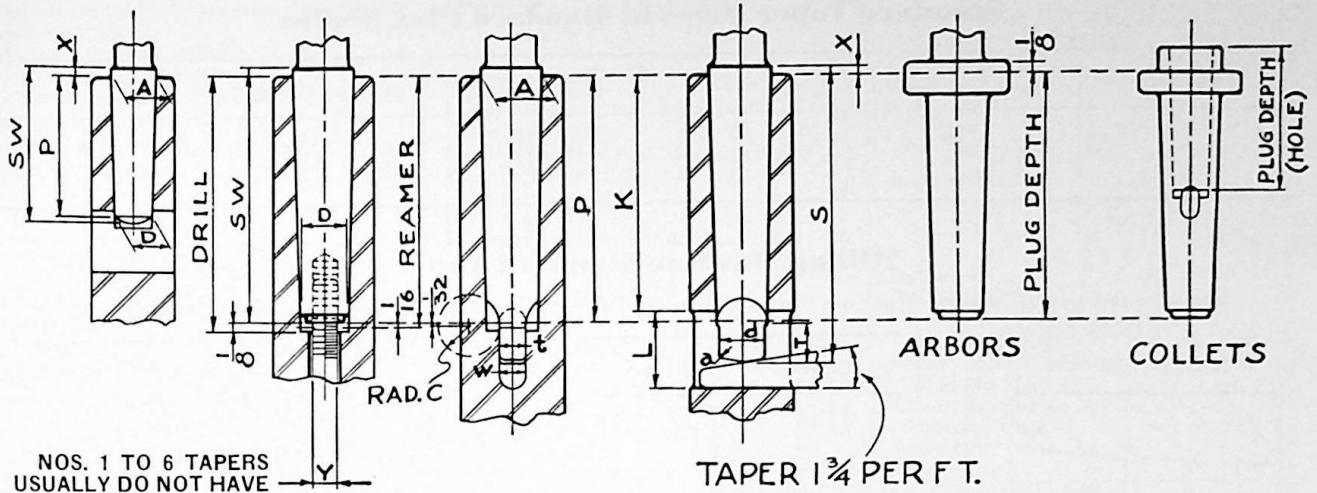
Weight of Iron and Steel Sheets—lbs.

Thickness by Birmingham Gage				Thickness by American (Brown & Sharpe's) Gage			
No. of Gage	Thickness, Inches	Weight per Sq. Ft.		No. of Gage	Thickness, Inches	Weight per Sq. Ft.	
		Iron	Steel			Iron	Steel
0000	.451	18.16	18.52	0000	.46	18.40	18.77
000	.425	17.00	17.34	000	.4096	16.38	16.71
00	.38	15.20	15.50	00	.3648	14.59	14.88
0	.34	13.60	13.87	0	.3249	13.00	13.26
1	.3	12.00	12.24	1	.2893	11.57	11.80
2	.284	11.36	11.59	2	.2576	10.30	10.51
3	.259	10.36	10.57	3	.2294	9.18	9.36
4	.238	9.52	9.71	4	.2043	8.17	8.34
5	.22	8.80	8.98	5	.1819	7.28	7.42
6	.203	8.12	8.28	6	.1620	6.48	6.61
7	.18	7.20	7.34	7	.1443	5.77	5.89
8	.165	6.60	6.73	8	.1285	5.14	5.24
9	.148	5.92	6.04	9	.1144	4.58	4.67
10	.134	5.36	5.47	10	.1019	4.08	4.16
11	.12	4.80	4.90	11	.0907	3.63	3.70
12	.109	4.36	4.45	12	.0808	3.23	3.30
13	.095	3.80	3.88	13	.0720	2.88	2.94
14	.083	3.32	3.39	14	.0641	2.56	2.62
15	.072	2.88	2.94	15	.0571	2.28	2.33
16	.065	2.60	2.65	16	.0508	2.03	2.07
17	.058	2.32	2.37	17	.0453	1.81	1.85
18	.049	1.96	2.00	18	.0403	1.61	1.64
19	.042	1.68	1.71	19	.0359	1.44	1.46
20	.035	1.40	1.43	20	.0320	1.28	1.31
21	.032	1.28	1.31	21	.0285	1.14	1.16
22	.028	1.12	1.14	22	.0253	1.01	1.03
23	.025	1.00	1.02	23	.0226	.904	.922
24	.022	.88	.898	24	.0201	.804	.820
25	.02	.80	.816	25	.0179	.716	.730
26	.018	.72	.734	26	.0159	.636	.649
27	.016	.64	.653	27	.0142	.568	.579
28	.014	.56	.571	28	.0126	.504	.514
29	.013	.52	.530	29	.0113	.452	.461
30	.012	.48	.490	30	.0100	.400	.408
31	.01	.40	.408	31	.0089	.356	.363
32	.009	.36	.367	32	.0080	.320	.326
33	.008	.32	.326	33	.0071	.284	.290
34	.007	.28	.286	34	.0063	.252	.257
35	.005	.20	.204	35	.0056	.224	.228

Specific gravity.....Iron 7.7 Steel 7.854
 Weight per cubic foot....." 480. " 489.6
 Weight per cubic inch....." .2778 " .2833

As many gages differ, and even the thicknesses of a certain specified gage are not assumed the same by all manufacturers, orders for sheets and wires should always state the weight per square foot or the thickness in thousandths of an inch.

Brown & Sharpe Tapers



NOS. 1 TO 6 TAPERS
USUALLY DO NOT HAVE
TANGS FOR END MILLS;
THESE TAPERS DO HAVE
TANGS FOR DRILLS.

Y—DIAMETER, NUMBER OF THREADS AND HAND, AS
SPECIFIED, TO MATCH DRAW-IN BOLT. (WHERE POSSIBLE,
HAND OF THREAD SHOULD MATCH HAND OF CUTTER).

All dimensions are in inches.

No. of Taper	Taper per Foot	Diam. of Plug at Small End		Plug Depth P			Key-way from End of Spindle	Shank Length with Tang	Shank Length without Tang	Shank Projects from End of Socket	Length of Key-way†	Width of Key-way	Length of Arbor Tongue	Diameter of Arbor Tongue	Thickness of Arbor Tongue	Radius of Tongue Circle	Radius of Tongue at a
		D	A	B & S** Standard	For Mill. Mach.	Miscell.											
*1	.50200	.20000	.2392	1 1/16 †			1 5/16	1 9/32	1 1/16	3/32	3/8	.135	3/16	.170	1/8	3/16	.030
*2	.50200	.25000	.2997	1 3/16 †			1 11/64	1 19/32	1 11/32	3/32	1/2	.166	1/4	.220	3/32	3/16	.030
			.3752	1 1/2 †			1 13/32	1 31/32	1 1/4	3/32	5/8	.197	5/16	.282	3/16	3/16	.040
*3	.50200	.31250				1 3/4	1 23/32				5/8	.197	5/16	.282	3/16	3/16	.040
						2	1 31/32					5/8	.197	5/16	.282	3/16	3/16	.040
4	.50210	.35000	.4023		1 1/4 †		1 13/16	1 3/4	1 25/64	3/32	11/16	.228	11/32	.320	1/2	5/16	.050
					1 1/16			1 41/64				11/16	.228	11/32	.320	1/2	5/16	.050
5	.50160	.45000	.5231		1 3/4 †		1 11/16	2 1/32	1 29/32	3/32	3/4	.260	3/8	.420	1/4	5/16	.060
					2			1 15/16				3/4	.260	3/8	.420	1/4	5/16	.060
6	.50329	.50000	.5996		2 1/8		2 1/16				3/4	.260	3/8	.420	1/4	5/16	.060
					2 3/8 †			2 19/64	2 23/32	2 17/32	3/32	7/8	.291	1/2	.460	3/32	3/16	.060
7	.50147	.60000			2 1/2		2 13/32				1 5/16	.322	1 1/2	.560	3/16	3/8	.070
					2 7/8			2 23/32				1 5/16	.322	1 1/2	.560	3/16	3/8	.070
8	.50100	.75000	.8987		3 †		3 29/32	3 5/8	3 33/32	3/32	1 5/16	.322	1 1/2	.560	3/16	3/8	.070
					3 3/16 †			3 29/64	4 1/4	3 11/16	1/8	1	.353	1 1/2	.710	1 1/2	3/8	.080
9	.50085	.90010	1.0670		4 †		4 1/8	4 3/4	4 1/8	1/8	1 1/8	.385	1 1/2	.860	3/8	1/2	.100
					4 1/4			4 23/32				1 1/8	.385	1 1/2	.860	3/8	1/2	.100
10	.51612	1.04465	1.2892		5		5 1/2	6 1/32	5 13/16	1/8	1 5/16	.447	2 1/32	1.010	1/2	3/16	.110
					5 11/16 †			5 17/32				1 5/16	.447	2 1/32	1.010	1/2	3/16	.110
11	.50100	1.24995			6 7/32		6 1/16				1 5/16	.447	2 1/32	1.010	1/2	3/16	.110
					5 15/16			5 23/32				1 5/16	.447	2 1/32	1.210	1/2	1/2	.130
12	.49973	1.50010	1.5318		6 3/4 †		6 19/32	7 19/32	6 7/8	1/8	1 5/16	.447	2 1/32	1.210	1/2	1/2	.130
			1.7968		7 1/8 †			6 15/16	8 1/16	7 1/4	1/8	1 1/2	.510	3/4	1.460	1 1/2	1 1/2	.150
13	.50020	1.75005	2.0730		6 1/4		7 7/16	8 11/16	7 7/8	1/8	1 1/2	.510	3/4	1.710	1/2	3/8	.170
					7 3/4 †			7 9/16				1 1/2	.510	3/4	1.710	1/2	3/8	.170
14	.50000	2.00000	2.3137		8 1/4		8 1/32	9 9/32	8 3/8	1/8	1 11/16	.572	2 1/32	1.960	3/16	3/4	.190
					8 3/4 †			8 17/32				1 11/16	.572	2 1/32	1.960	3/16	3/4	.190
15	.50000	2.25000	2.6146		9		9 1/32	10 23/32	9 7/8	1/8	1 11/16	.572	2 1/32	2.210	3/16	7/8	.210
					9 1/4 †			9 1/32				1 11/16	.572	2 1/32	2.210	3/16	7/8	.210
16	.50000	2.50000	2.8854		9 3/4 †		10 1/32	11 1/32	10 3/8	1/8	1 7/8	.635	1 1/2	2.450	5/8	1	.230
					9 3/4 †			10 1/32				1 7/8	.635	1 1/2	2.450	5/8	1	.230
17	.50000	2.75000	3.1562		10 1/4 †		10 3/32	11 3/32	10 3/8	1/8							
					10 1/4 †			10 3/32									
18	.50000	3.00000	3.4271		10 3/4 †		10 3/8	11 3/8	10 3/8	1/8							

*Adopted by American Standards Association.
**"B & S Standard" Plug Depths are not used in all cases.
†These lengths are standard for shank cutters.

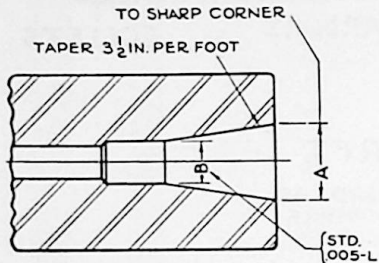
†Special lengths of keyway are used instead of standard lengths in some places. Standard lengths need not be used when keyway is for driving only and not for admitting key to force out tool.

Approximate Diameters at Large Ends of Brown & Sharpe Standard Taper Holes at Standard Plug Depths

No. of Taper	Approx. Diam. at Large End, Inches	No. of Taper	Approx. Diam. at Large End, Inches	No. of Taper	Approx. Diam. at Large End, Inches
6	19/32	10	1 1/4	14	2 11/32
7	23/32	11	1 1/2	16	2 7/8
9	1 1/16	12	1 13/16	18	3 7/16

Milling Machine Standard Tapers

As adopted by the Milling Machine Manufacturers of the National Machine Tool Builders' Association



No. of Taper	A, Inches	B, Inches	*Threaded End of Draw-In Bolt
10	5/8	3/8	1 1/2" 13 N.C., R.H.
20	7/8	1/2	
30	1 1/4	5/8	
40	1 3/4	1	1 5/8" 11 N.C., R.H.
50	2 3/4	1 9/16	1" 8 N.C., R.H.

*End of Draw-In Bolt is threaded with two sizes of thread. The larger size thread is used in threaded hole in Arbors and in Adapters where possi-

ble, but limitations on certain Adapters require the use of a threaded hole to fit the smaller Threaded End of the Draw-In Bolt.

The Jarno Taper

Taper per Foot = 0.6 Inch.

Taper per Inch = 0.05 Inch.

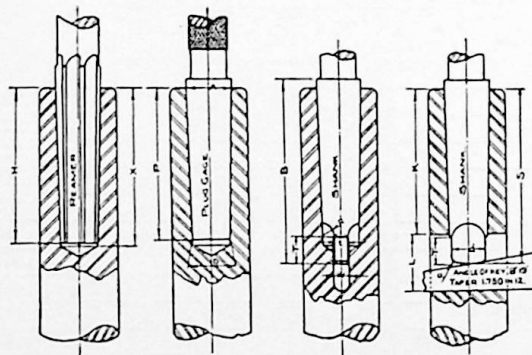
$$\text{Diam. Large End} = \frac{\text{No. of Taper}}{8}$$

$$\text{Diam. Small End} = \frac{\text{No. of Taper}}{10}$$

$$\text{Length of Taper} = \frac{\text{No. of Taper}}{2}$$

In the Jarno system, the taper of which is 0.6 inch per foot or 1 in 20, the number of the taper is the key by which all the dimensions are immediately determined. That is, the number of the taper is the number of tenths of an inch in diameter at the small end, the number of eighths of an inch at the large end, and the number of halves of an inch in length or depth. For example: the No. 6 taper is six-eighths (3/4) inch diameter at large end, six-tenths (3/5) inch diameter at the small end and six-halves (3) inches in length. Similarly, the No. 16 taper is sixteen-eighths, or 2 inches diameter at the large end; sixteen-tenths or 1.6 inches at the small end and sixteen-halves or 8 inches in length.

Morse Tapers



All dimensions are in inches.

Number of Taper	Diam. of Plug at Small End	Diam. at End of Socket	SHANK		Depth of Drilled Hole	Depth of Reamed Hole	Standard Plug Depth	TONGUE			KEYWAY		End of Socket to Keyway	Taper Per Inch	Taper Per Foot	Number of Key		
			Whole Length	Depth				Thickness	Length	Radius	Diameter	Radius					Width	Length
	D	A	B	S	X	H	P	t	T	R	d	a	W	L	K			
0	.252	.3561	2 1/32	2 7/32	2 1/16	2 1/32	2	.1562	1/4	5/32	.235	.01	.160	9/16	1 15/16	.052050	.62460	0
1	.369	.475	2 9/16	2 25/16	2 3/16	2 1/8	2 1/8	.2031	3/8	3/16	.343	.05	.213	3/4	2 1/16	.049882	.59858	1
2	.572	.700	3 1/8	3 1/16	3 1/16	3 1/8	3 1/8	.250	7/16	1/4	.17	.06	.260	7/8	2 1/2	.049951	.59941	2
3	.778	.938	3 7/8	3 11/16	3 3/16	3 1/4	3 3/16	.3125	9/16	5/32	.23	.08	.322	1 1/2	3 1/16	.050196	.60235	3
4	1.020	1.231	4 1/8	4 5/8	4 3/16	4 1/4	4 1/8	.4687	5/8	3/8	.10	.10	.478	1 3/4	3 7/8	.051938	.62326	4
5	1.475	1.748	5 1/8	5 5/8	5 1/16	5 1/4	5 1/8	.6250	3/4	3/8	.12	.12	.635	1 1/2	4 1/16	.052626	.63151	5
6	2.116	2.494	8 7/16	8 1/4	7 13/32	7 1/2	7 1/4	.750	1 1/8	1/2	.15	.15	.760	1 3/4	7	.052137	.62565	6
7	2.750	3.270	11 5/8	11 1/4	10 5/32	10 3/4	10	1.125	1 3/8	3/4	.18	.18	1.135	2 5/8	9 1/2	.05200	.6240	7

INDEX

	Page
A	
Adapter Bushings, Cutter.....	59
Adapters, Milling Machine... 46, 54-	59
Angular Cutters.....	30
Arbor Adapters, Milling Machine... 54	
Blanks, Drill Chuck.....	53
Sleeves, Milling Machine.....	49
Arbors—	
Cam Lock, Milling Machine.....	49
Milling Machine.....	46-53
B	
Bevel Gear Cutters.....	42, 43
Blanks, Collet.....	61
Bolts, Draw-In.....	54, 61
Bushings, Cutter Adapter.....	59
C	
Cam Lock.....	18
Lock Arbors.....	49
Carbide Cutters.....	9
Chuck Adapters, Milling Machine... 58	
Chucks—	
Spring, Grinding Machine.....	64
Spring, Milling Machine.....	63
Clearance on Cutters.....	6
Climb Milling.....	8
Coarse-Tooth Milling Cutters.....	11
Collet Blanks.....	61
Collets—	
Milling Machine... 46, 59, 60, 62, 63	
Polishing and Finishing	
Machine.....	61
Concave Cutters.....	31
Convex Cutters.....	31
Corner-Rounding Cutters.....	31
Cutter Adapters..... 54-59	
Arbors.....	46-53
Clearances.....	6
Keyways, Standard.....	32
Cutters—	
Angular.....	30
Carbide.....	9
Coarse-Tooth Milling.....	11
Concave.....	31
Convex.....	31
Corner-Rounding.....	31
Double Angle.....	30
End Mill.....	18-28
Face Milling.....	16, 17
Gear.....	38-44
Ground Formed.....	36
Half Side Milling.....	15
Helical Plain Milling.....	7, 12
Milling.....	5-44
Plain Milling.....	10, 12
Screw Slotting.....	34, 35
Side Milling.....	13-16
Special.....	7
Spiral Mill.....	30
Sprocket Wheel.....	36, 37
Staggered Tooth Side Milling... 13	
Stocking, Involute Spur Gear... 44	
T Slot.....	28
Woodruff Key Seat.....	29
Cutting Lubricants.....	6
D	
Double Angle Cutters.....	30
Draw-In Bolts.....	54, 61
Drill Chuck Arbor Blank.....	53

	Page
E	
End Mills.....	18-28
F	
Face Milling Cutter Arbors.....	50
Milling Cutters.....	16, 17
Feeds and Speeds for Milling Cutters 6	
Finishing and Polishing	
Machine Collets.....	61
Fly Cutter Arbors.....	52
Formed Cutters, Ground.....	36
G	
Gaging Equipment.....	66
Gear Cutters..... 38-44	
Teeth, Comparative Sizes.....	45
Grinding Machine Chucks.....	64
Ground Formed Cutters.....	36
H	
Half Side Milling Cutters.....	15
Helical Plain Milling Cutters.....	7, 12
I	
Involute Spur Gear Cutters... 38-44	
J	
Jewelers' Saws.....	35
K	
Key Seat Cutters, Woodruff.....	29
Keyways, Cutter, Standard.....	32
L	
Lock, Cam.....	18
Lubricants, Cutting.....	6
M	
Machinists' Tools.....	65
Metal Slitting Saws.....	32, 33
Milling, Climb.....	8
Milling Cutter Information 5-9, 18, 38	
Cutters.....	5-44
Machine Adapters.....	54-59
Machine Arbor Sleeves.....	49
Machine Arbors.....	46-53
Machine Chucks.....	63
Machine Collets... 46, 59, 60, 62, 63	
Mills—	
End.....	18-28
Shell End.....	28
Mitre Gear Cutters.....	42, 43
O	
Other Useful Equipment..... 68, 69	
Ground Flat Stock, Vises, Permanent Magnet Chucks, Bench Centers, Spur Gear Testing Fixture, Cast Iron Surface Plates, Cast Iron Straight Edges, Work Driving Dogs, Index Plates, Taper Mandrels and Expansion Bushings, Lathe Mandrels, and Publications	

	Page
P	
Plain Milling Cutters.....	10, 12
Polishing and Finishing	
Machine Collets.....	61
Pumps.....	67
R	
Rotary Shears.....	33
S	
Saws—	
For Soft Metals.....	32
Jewelers'.....	35
Metal Slitting.....	32, 33
Screw Arbors, Milling Machine... 53	
Machine Tools.....	67
Slotting Cutter Arbors.....	53
Slotting Cutters.....	34, 35
Setting of Gear Cutters.....	38
Sharpening Cutters.....	5, 6, 38
Shell End Mill Arbors.....	51, 52
Mills.....	28
Side Milling Cutters.....	13-16
Sleeves, Arbor, Milling Machine... 49	
Slitting Saws, Metal.....	32, 33
Slotting Cutters, Screw.....	34, 35
Special Cutters.....	7
Speeds and Feeds for Milling	
Cutters.....	6
Spiral End Mills.....	18-28
Mills, Cutters for.....	30
Spring Chucks, Grinding	
Machine.....	64
Chucks, Milling Machine.....	63
Collets, Grinding Machine.....	64
Collets, Milling Machine 59, 60, 62, 63	
Collets, Polishing and Finishing	
Machine.....	61
Sprocket Wheel Cutters.....	36, 37
Spur Gear Cutters.....	38-44
Staggered Tooth Side Milling	
Cutters.....	13
Stocking Cutters, Involute	
Spur Gear.....	44
Straddle Sprocket Cutters.....	36
T	
T Slot Cutters.....	28
Tables..... 70-78	
Allowance for Fits.....	74
Brown & Sharpe Tapers.....	77, 78
Cutting Speeds.....	75
Decimal Equivalents.....	70
Hardness Conversion.....	76
Jarno Tapers.....	78
Measures of Weight.....	71
Metric and English	
Equivalent Measures.....	71
Millimeter Equivalents.....	70
Milling Machine Standard Tapers. 78	
Morse Tapers.....	78
Speeds and Feeds for Milling	
Cutters.....	6
Tap Drill Sizes.....	72, 73
Unified and American Form	
Threads.....	72, 73
United States Standard Gage Sizes 74	
Weight of Iron and Steel Sheets... 76	
Teeth, Gear, Comparative Sizes... 45	
Tungsten Carbide Cutters,	
see Carbide Cutters.....	9
W	
Woodruff Key Seat Cutters.....	29

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