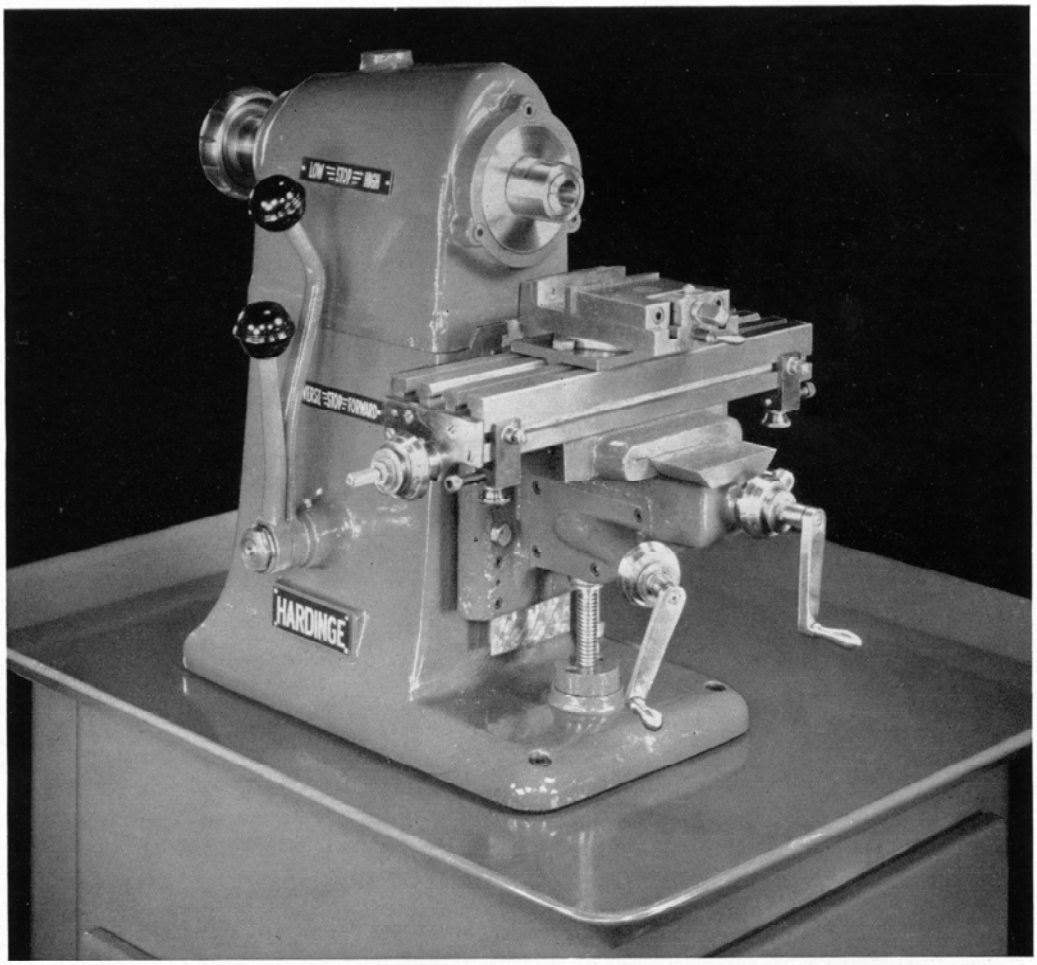
HARDINGE

PRECISION MILLING MACHINE

WITH

PRELOADED BALL BEARING SPINDLE CONSTRUCTION



Hardinge BB4 Horizontal Precision Milling Machine

Collet Capacity—Cutter Headstock and Index Head		¾″
Collet Used—Dimensions in Collet Bulletin		4C HARDINGE
Size of Arbor Chuck		½″
Eight Spindle Speeds		180 to 3000 R.P.M.
Maximum Distance Between Centers		5″
Distance From Center of Spindle to Lowest Position of Table		5-5/16″
Micrometer Controlled Travel of Table	Longitudinal	5″
	Transverse	3-⅛″
	Vertical	5″
Table Working Surface		12″ x 3-3/16″
Floor Space—Required with Doors Open		39″ x 38″

Regular Equipment: Base complete with stops and micrometer indexed feed screws; speed change levers; fully enclosed ball bearing cutter headstock with draw spindle; necessary wrenches; pedestal driving unit complete.

Extra Equipment: Arbor; Index Head with sixty notch Index Plate; Draw Spindle and Index Center; Tailstock with Center; Swivel Vise with graduated base; Swivel Base; Universal Adapter; and Lever Feed for table.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"Performance has established leadership for Hardinge"

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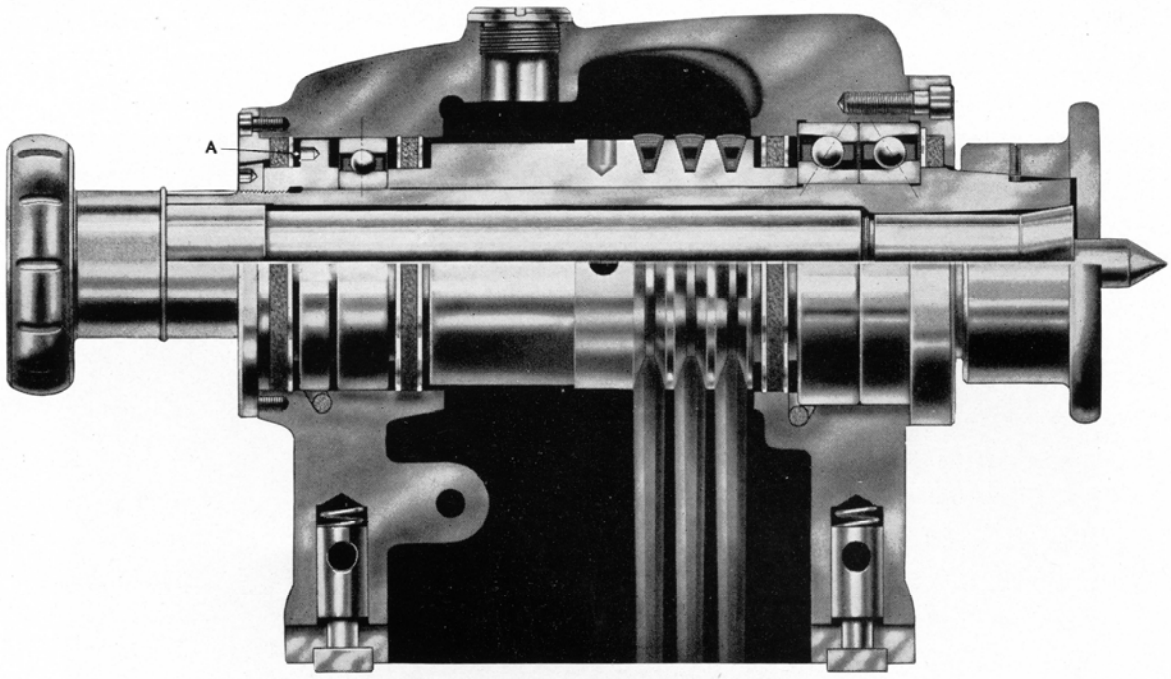
HARDINGE PRECISION PRELOADED BALL BEARING HEADSTOCK



CROSS SECTION OF HARDINGE ENCLOSED HEADSTOCK WITH PRELOADED BALL BEARINGS

SUPER-PRECISION Duplex Ball Bearings with preloading, as described in this bulletin, provide extreme accuracy and high spindle speeds with *the bearings requiring no adjustment.* The desirable results are so surprising that actual use is the best medium to determine the advantages over your present machines.

HEADSTOCK: The headstock frame is of the finest grade, seasoned and heat-treated alloy iron and has a hand scraped bearing surface to fit the ways of our amply proportioned milling machine base.

The outstanding feature is the *connected bearing, enclosed headstock.* The design has been successfully used with our machines over a number of years. Reflection will indicate that machine tool builders are offering enclosed headstock units: First, to assure greater accuracy; Second, to allow heavier cuts; Third, to permit higher spindle speeds; Fourth, to completely enclose driving belts. The enclosed headstock is the logical design for a ball bearing spindle, as it meets accuracy and speed requisites.

The spindle is hardened and ground, both internally and externally, and is made of the best grade ball bearing steel. With the ball bearing construction, the spindle is mounted in rotating members to eliminate wear on the spindle — an unusual feature for a milling machine. The spindle pulley is provided with four holes for locking by means of a substantial pin at the rear of the headstock.

BALL BEARINGS: Work load on a sleeve bearing is supported by a film of oil, the functioning of which is dependent upon such variable factors as film thickness, temperature and difference in the grades of oil used. With a preloaded ball bearing, the pressure between balls and races is such as to prevent formation of an oil film and the contact of load carrying members is positively metal-to-metal. In other words, the load is carried on perfect spheres of hardened steel instead of globules of oil whose load-carrying ability varies with the operating temperature. Naturally, accuracy with speed and long life is attained.

The preloading and the resultant load-carrying capacity is not a matter of experiment, but is subject to as accurate a mathematical determination as is the strength of a steel bridge. The steel ball, because of its shape, presents a uniform and calculable resistance. The balls automatically adjust themselves to the proper angle for either purely end or radial thrust, or a combination of the two.

Proper steel, vast improvement in manufacturing methods and the use of optical gages have achieved a uniform standard of accuracy, considered commercially impossible a few years ago.

ATTACHMENTS ILLUSTRATED AND DESCRIBED ON PAGE BB4-FOUR

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A HARDINGE PRECISION MILLING MACHINE is a sturdy, responsive, time saver which will give rapid and accurate milling service for production, tool room and experimental purposes.

In the development of the milling machines, special features and compactness were combined for ease of operation and to give results which cannot be obtained with large and cumbersome milling machines.

Convenience, dependability and ever increasing value, as with our Precision Lathes and Second Operation Machines, warrant the purchase of a Hardinge Precision Milling Machine.

Additional Features

1. Top of base has our standard Precision Lathe ways.
2. Cutter Headstock is of the same type as used with our Precision Lathes.
3. Enclosed Headstock design gives "Connected Bearing" feature.
4. Collets interchange between the Cutter Headstock and Index Head.
5. Properly proportioned base, table, saddle and knee.
6. Dovetailed slides properly gibbed for adjustment.
7. All slides hand scraped to a perfect fit.
8. Travel of slides comparable with larger milling machines.
9. Adjustable stops of rigid design for longitudinal, transverse and vertical travel.
10. Positive locks for table, saddle and knee.
11. Width of table equal to larger milling machines.
12. Table has center V-slot to automatically align attachments.
13. Table has three slots for standard T-bolts for clamping of work and fixtures.
14. Feed screws have accurately finished threads.
15. Feed screws revolve in long, adjustable bronze nuts.
16. All feed screws have friction dials graduated in thousandths of an inch.
17. Dial graduations are clearly cut for ease of reading.
18. Vertical feed screw actuated by bevel gears with 1/1 ratio.
19. Dial control of the vertical travel is then the same as longitudinal and transverse.
20. The bevel gears are completely enclosed to exclude dirt and chips.
21. A precision ball bearing absorbs the thrust on the vertical feed screw.
22. Removable handles for ¼" square end of feed screws.
23. Handles interchange for use with locks on stops.
24. A variety of standard attachments increases the serviceability of the machine.
25. Ready for immediate application of standard attachments at any time.
26. Lever feed for table is available.
27. Conveniently located lever control for speed changes.
28. Silent, powerful vee belt drive—no gears, clutches or loose pulleys.

Collets and Arbors: Complete Split Collet; Taper Collet and Arbor information is given in our Collet Bulletin and Precision Lathe Attachment Bulletin.

Driving Unit: The machine is furnished completely assembled on the welded steel pedestal. The electrical driving unit is fully enclosed. The pedestal also has a section for storage of collets and attachments. The chip pan measures 24" x 29". There are no loose pulleys, driving gears or clutches in the driving unit. The horizontal spindle is driven by three vee belts from the electrical driving unit. The two levers at the machine provide convenience in the operation of electrical switches for LOW - STOP - HIGH and FORWARD - STOP - REVERSE spindle speeds.

Eight spindle speeds ranging from 180 to 3000 r.p.m. forward and reverse are obtainable.

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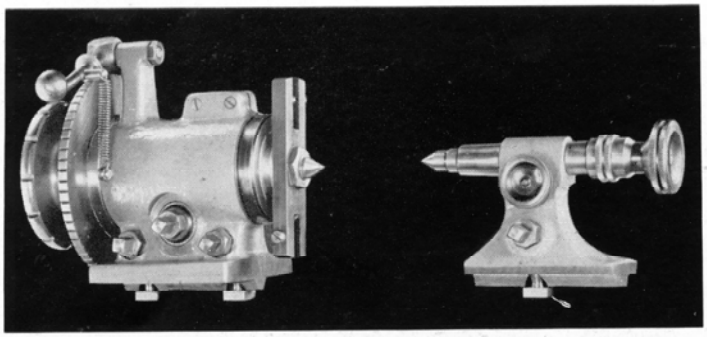
Index Head and Tailstock: HARDINGE Precision Milling Machine Index Heads are constructed for rapid and unerring indexing and have many features to maintain the original accuracy. The spindle adapts the same collet as used in the Cutter Headstock.



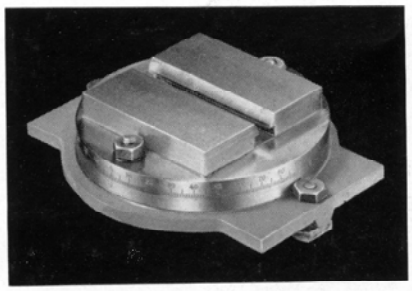
The hardened and ground spindle has an integral flange for index plates and is provided with a nut to take up end play. The body has an adjustment to maintain a perfect spindle fit and has a binding bolt for locking the spindle when heavy cuts are taken.

The Tailstock is hand scraped for alignment with the Index Head. A large knurled nut operates a binding bolt for locking the spindle. The spindle has a discharge plug for the center.

The Index Head is furnished with a notched draw spindle for collets, spanner wrench, center, indexing bar and a 4" diameter index plate with sixty notches. Index plates are available with any number of notches up to and including three hundred sixty. The Tailstock is furnished with a center.

Specifications: Index Head: Overall length 6⅜", Base 3" x 3" with hand scraped surface. Swings work 4¼" in diameter. **Tailstock:** Base 1⅜" x 3" with hand scraped surface. Spindle has No. 3 HARDINGE taper. Travel of spindle is 1½".

Swivel Base: By mounting on this Swivel Base, the Index Head, Universal Adapter or a special fixture can be placed at any desired angle in a horizontal plane with the table.

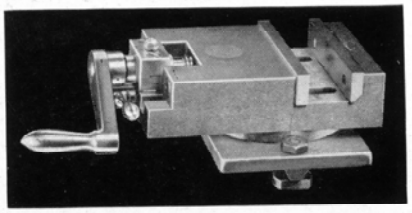


Without an attachment of this kind, taper or angular milling with an Index Head cannot be accomplished on a plain milling machine, swivel table type not excepted. The Swivel Base places work as it should be, at an angle with the longitudinal travel of the table.

The base for attachments is integral with the graduated swivel.

Specifications: Base 5¾" x 2¾" with hand scraped surface (Circular section 4½" in diameter). 1¼" overall height. 3" x 3" hand scraped surface for attachments.

Swivel Vise: The Vise is solidly built. The compact construction minimizes the overall height, giving the greatest degree of accuracy and rigidity for milling operations—this is an important requirement for a milling machine vise.



The slide is adjustable to compensate for wear. It is controlled by an accurately milled 12-pitch thread screw which has a replaceable bronze nut. The jaws are hardened and then ground in place. The vise may be swivelled to any angle and has both a steadying and a positive lock to hold the desired position. The graduated section is an integral part of the base.

Specifications: Overall length less handle 6". Overall height 1-11/16". Base 4-5/16" x 3" with hand scraped surface. Jaws 3-1/8" wide x 5/8" deep. Jaws open 1-1/4".

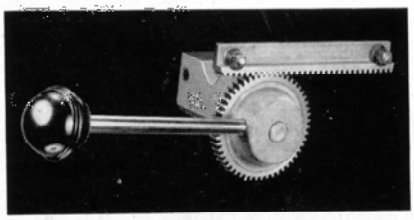
Universal Adapter: This attachment fits on the milling machine table, automatically placing its swivel table at a perfect right angle to the Cutter Headstock. The swivel table receives either the Index Head and Tailstock or the Vise.

A Universal Adapter allows work to be milled with any angle in a vertical plane. It can be mounted on the Swivel Base described above and all conceiveable angular milling operations may be easily accomplished. This sturdy attachment gives advantages which are not available in larger and expensive milling machines.

The graduated section is an integral part of the table for attachments. Four ¼" bolts securely hold the desired angular setting. The tailstock end of the table is supported by an adjustable, hardened stud.

Specifications: Base 3-3/4" x 3-1/16" with hand scraped surface. Swivel table is 10" long. Swivel is 3-1/2" in diameter and graduated 135° each side of zero.

Lever Feed: The Lever Feed is used for rapid and sensitive production milling machine work. The attachment is equipped with antifriction bearings, which are grease packed. To apply the Lever Feed, the table screw nut is disengaged and the attachment fastened to the machine as follows: The frame containing the bearings, shaft, gear and ball lever is held to the milling machine saddle by two standard screws and dowel pins. The rack is held in the desired position along the T-Slot in the side of the milling machine table by two heat-treated steel T-Bolts.



When in place on the table, the feed lever is on the same side as the electric control levers, thus affording convenient and efficient operation.

The full gear on the lever shaft allows adjustment so that the ball handle is in the most convenient operation position for the particular set-up. Accurately cut teeth permit a smooth flow of power from the properly adjusted lever to the table. The travel of the table is controlled by the standard table stops.

Specifications: Lever is 8" long. Maximum table travel 4-½".

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