Brown& Sharpe Mfg.C. Providence, RL, U.S.A. Calalog of MACHINERY & TOOLS

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IMPORTANT

List Prices in this catalog have been revised in accordance with the enclosed blue pamphlet. Prices on all High Speed Steel Screw Machine Tools are withdrawn temporarily.

Pages of this catalog listing cutters, are obsolete. For Cutters see Cutter Catalog No. 27-S. BROWN & SHARPE MFG. CO.

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BROWN & SHARPE MFG. CO., PROVIDENCE, R. I., U. S. A.



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OF 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, and in 1852 Samuel Darling began a similar line of work. The partnership of Darling, Brown & Sharpe was formed in 1866 for carrying on this branch of the business, and it remained under that name until the partnership was dissolved by the purchase of Mr. Darling's interest.

The Works since 1872 have been situated one-half mile from the business centre of Providence, and are five minutes' walk northwest from the Union Railroad Station.

The Buildings are modern and especially arranged to meet the requirements of the business. The machine shops are fireproof, and therefore the business is free from danger of serious interruption, and, on work intrusted to us, customers are given security against loss by fire.

Floor Area. The five main manufacturing buildings have a floor space of about 545,000 square feet, and the foundry about 239,000 square feet. In 1853 the floor space occupied was 1,800 square feet; the present buildings have 1,029,900 square feet of floor space, or about 23½ acres. The Machines and Tools described in this catalogue are made with the purpose that they shall be the best in their respective classes. Careful attention is constantly given to insure workmanship of the best quality. Cylindrical bearings are accurately

ground; plane bearings are scraped to surface plates that are kept trued by means of master plates. All alignments are correct.

Improvements are constantly being made in our machines and tools, thus adapting them to the latest requirements of machine shop practice.

All machinery is subjected to careful inspection and, when deemed requisite, to actual operation before being packed.

Should any defect become apparent in the workmanship of any of our machines or tools, we request that we be notified promptly.

The Floor Space Dimensions of machines cover the extreme projections and points of travel of the various parts.

The Speeds of Counter-shafts given in catalogue are only approximate and must be varied according to the nature of the work and the circumstances under which the tools are used.

Drawings, showing plans of our machines and countershafts, can be had on application by those who contemplate purchasing machinery in our line. These drawings are also sent upon receipt of order for any of our machines. They supplement the Floor Space Dimensions given in catalogue by indicating how tools can be advantageously overlapped or arranged to run by each other.

Orders. We request our customers to use the names or numbers of tools, as printed in the catalogue.

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This will enable us to fill orders promptly and correctly.

Machine Tools can be ordered direct or through our representatives. See list in back of book.

Small Tools are carried in stock and sold by instrument and hardware dealers throughout the country. In cases where these cannot readily be procured from dealers, we will send any of our small tools, upon receipt of price, to any place ip the United States or Canada.

Cutters may usually be obtained at once and the delay and cost of transportation saved.

Standard Gears may also be obtained from hardware and machinists' supply dealers, and are carried in stock by our agents throughout the country. See page 398.

Catalogues of the Latest Edition should be kept on hand. We are pleased to mail a copy to any address. Old catalogues should be destroyed. When reference is made to page, give number of catalogue found on cover. The prices and dimensions are subject to change without notice.

Pamphlets or Circulars describing the construction and use of the various machines are furnished on application.

Publications on Milling and Grinding Machines, Practical Treatise on Gearing, Formulas in Gearing and Hand Book for Apprenticed Machinists may be obtained through booksellers, hardware and instrument dealers, or are mailed on receipt of price, as per catalogue.

We would impress upon purchasers the advantage of ordering, when possible, articles that are carried in stock, in the place of goods that vary slightly from these and have to be made to order.

In ordering special tools to be graduated and figured, our customers are particularly requested to send a clear description and a sketch showing the exact position of figures and graduations wanted.

When goods are ordered to be sent by express, with bill to be collected on delivery, the express charge for collecting will be added. Small articles can be sent by mail when additional cost of postage is remitted. We are not responsible for losses in the mail.

The Machines and Tools described in this catalogue are usually kept in stock and will be packed and delivered at railroad or steamer in this city, without extra charge.

Verbal Orders and Instructions should be confirmed in writing.

Please address all business communications to the Company.

We carry a representative line of machine tools and a complete line of small tools at our Western Office and Store, 626-630 Washington Boulevard, Chicago, Ill.

We also carry representative lines of machine and small tools at our New York Office, 20 Vesey Street, Rooms 900, 902.

Our Philadelphia Office is 653-654 The Bourse; the Rochester Office is 305 Chamber of Commerce Building; the Syracuse Office is 419 University Block. Medals Awarded: London, 1862; Paris, 1867 and 1878; Vienna, 1873; Philadelphia, 1876; Chicago, 1893; Tennessee Centennial Exhibition, 1897, and Buffalo, 1901. At Paris, 1889 and 1900; at Brussels, 1897 and 1910, the Grand Prix; at St. Louis, 1904, the Grand Prize; at Liège, 1905, and at Milan, 1906, Turin, 1911, the Grand Prix.



The Willcox & Gibbs Sewing Machines for family and factory use have been made by us for more than fifty years and we refer to them as an illustration of the quality of our work.

We are always ready and glad to show our works to those who contemplate purchasing machinery or are interested in machine shop or foundry practice.

BROWN & SHARPE MFG. CO.

FIGURES SHOWING CAPACITY OF MACHINES.

At the head of most of the pages devoted to machinery we have placed, immediately under the number of each machine, the figures that best indicate its capacity—the object being to assist those who desire to quickly compare machines, or wish to remember or designate them by their size in a way that is customary with lathes and planing machines. In some cases this plan is novel, so we have repeated the figures of capacities below the illustrations of the machines. For example: the illustrations of one of the Grinding Machines is headed, No. 1, $10'' \ge 24''$, Universal Grinding Machines, and is followed by the words, "The machine swings 10'' in diameter and takes 24'' in length."

CONSTRUCTION NUMBERS.

For Ordering Tools, Attachments and Duplicate Parts.

In ordering tools, attachments or duplicate parts of machines, it is necessary to give the construction number of the machine.

These numbers may be located as follows:

Universal and Plain Milling Machines: above spindle on frame, top front of table, top front of knee.

Vertical Spindle Milling Machines: Nos. 1, 2 and 3, top front of table, top front of knee, front of upper box on spindle head; No. 5, top front of table and top front of ways.

Universal Grinding Machines: top front of swivel table.

Plain Grinding Machines: top front side of guide on table.

Surface Grinding Machines: No. 2, top front of upright, top of table; No. 3, top front of wheel slide.

No. 1 Tool Grinding Machine: top of rest support.

No. 2 Cutter Grinding Machine and No. 3 Universal Cutter and Reamer Grinding Machine: spot, top of guide bar bracket.

No. 12 Universal and Tool Grinding Machine: front side of saddle table; and No. 13, front side of swivel table.

Automatic Gear Cutting Machines: top left-hand side of upright, outer support for work arbor.

Plain and Wire Feed Screw Machines: front side of front box.

Automatic Screw Machines: front side of rear box.

No. 1

2

22 in. x 8 in. x 18 in.

UNIVERSAL MILLING MACHINE.

Fatented Feb. 6, 1900; Nov. 12, 1901; Jan. 13, 1903; July 11, Sept. 5, Dec. 12, 1905; April 30, 1907.



Capacity:

LONGITUDINAL FEED, 22" AUTOMATIC. **TRANSVERSE FEED. 8"** VERTICAL FEED, 18".

Centres swing 10" in diameter, take 19" in length.

No. 1 22 in. x 8 in. x 18 in. UNIVERSAL MILLING MACHINE.

3

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end threaded, 2 1-2" diameter, 4, L.H. Has No. 10 taper hole. Hole through, 21-32" diameter. Drive. Cone, 5 steps, largest 10 3-4" diameter. 3" belt. 10
- changes of spindle speed in geometrical progression; 44 to 310 revolutions per minute, in either direction.
- Arbor Support. Overhanging arm, solid steel. Both bearings clamped with one lever. Centre of spindle to under side of arm, 51-2". Bronze bushing for arbor bearing, hole 1 13-16" diameter. Adjustable centre. Greatest distance,
- end of spindle to centre in arbor support, 21 3-4". **Table**. Including oil pans and channels, 41 3-4" x 10 3-4". Working surface, 36 1-4" x 10 3-4". 3 T slots, 5-8" wide. Quick return operated by internal gear and pinion. Arc of swing, 280°. Elevating screw, telescopic. Knee clamped from front. Provision for driving 18" Circular Milling Attachment.
- Feeds. Positive. All spur gears driven by chain. 20 changes in geometrical progression, from .003" to .150" per revolution of spindle. No loose change gears. Changes made by adjustment of index slide and levers. Automatic feed can be used with table set at any angle to 50° either side of 0. Feed tripping mechanism, double plunger type. Hand wheels clutched.
- Spiral Head and Foot-stock Centres. Swing 10" diameter, take 19". Head can be set at any angle from 10° below hori-zontal to 5° beyond perpendicular. Graduated to half degrees. Front end of spindle threaded, 2 1-4" diameter, 4 1-2, R.H. Has No. 10 taper hole. Hole through, 1 1-16" diameter. Foot-stock centre adjustable in vertical plane. Index crank adjustable. Sector arms graduated.
- Differential Indexing. All divisions from 1 to 382.
- Adjustable Dials. Graduated to thousandths of an inch.
- Tank. Cast in base; capacity 7 gallons. Provision for pump inside frame.
- Wise. Swivels. Base graduated. Jaws hardened, 51-8" wide, 1 1-4" deep, open ? 3-4".
 Counter-shaft. Driven by one pulley, 14" diameter. 3" belt. 130 revolutions per minute. 2 speeds in either direction obtained by gearing in counter-shaft. Floor Space. Right angles to spindle, 82". Parallel to spin-
- dle, 80".
- Weights. Net, about 2800 lbs.; ready for shipment, about 3350 lbs. Dimensions for shipment, 60" x 35" x 68" and 50" x 20" x 25".

Space occupied, about 83 cubic feet; about 15 cubic feet. Equipment. No. 2-S swivel vise, change gears, index plates and tables explaining the use of same, 6" 3-jawed chuck, "DD" collet, centre rest, raising block, wrenches and everything else shown in cut, together with overhead works.

Price. F.o.b. Providence, R. I. \$ Pump,\$ extra.

No. 1A 22 in. x 8 in. x 18 in. UNIVERSAL MILLING MACHINE.

Constant Speed Drive.

Patented Feb. 6, 1900; Nov. 12, 1901; Jan. 6, Jan. 13, 1903; July 11, Sept. 5, Dec. 12, 1905; April 30, May 28, 1907. Others pending.



Capacity:

LONGITUDINAL FEED, 22" | AUTOMATIC. **TRANSVERSE FEED. 8"** VERTICAL FEED, 18".

Centres swing 10" in diameter, take 19" in length.

No. 1A 22 in. x 8 in. x 18 in. UNIVERSAL MILLING MACHINE.

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for
- wear. Front end threaded, 2 1-2" diameter; 4 L.H.; has No. 10 taper hole. Hole through, 21-32" diameter. Drive. 1 friction clutch pulley, 11" diameter. 3" belt. Runs on ball bearings at constant speed, 300 revolutions per minute. Ratio of gearing, 1 to 7.31: 1. 12 changes of speed in geometrical progression, 41 to 427 revolutions per minute, in either direction. Changes made by adjustment of index slide and levers. Reverse within machine. Locking device for tumbler gear.
- Arbor Support. Overhanging arm, solid steel. Both bearings clamped with one lever. Centre of spindle to under side of arm, 5 1-2". End of spindle to centre in arbor support, without arm braces, 21 3-4". Bronze bushing for arbor bear-ing, hole 1 13-16" diameter. Adjustable centre. Arm braces furnished. End of spindle to arbor bushing, with arm braces, 17". Face of column to arm braces, 21 3-4".
 Table. Including oil pans and channels, 41 3-4" x 10 3-4". Working surface, 36 1-4" x 10 3-4". 3 T slots, 5-8" wide. Quick
- return operated by internal gear and pinion. Arc of swing, 280°. Elevating screw, telescopic. Knee clamped from front. Provision for driving 18" Circular Milling Attachment.
- Freeds. Positive. All spur gears driven by chain direct. Safety device in gear train. 20 changes in geometrical progression, from 3-10" to 15" per minute. Independent of spindle speeds. Range for small mills, .0007" to .035" per revolution of spindle; large mills, .0073" to .366". No loose change gears. Changes made by adjustment of index slide and levers. Automatic for dear to be used with the table set to 500 either side of 0. feed can be used with the table set to 50° either side of 0. Feed tripping mechanism, double plunger type. Hand wheels clutched.
- Spiral Head and Foot-stock Centres. Swing 10" diameter; take 19". Head can be set to any angle from 10° below horizontal to 5° beyond perpendicular. Graduated to half degrees. Front end of spindle threaded, 2 1-4" diameter, 41-2, R.H.: has No. 10 taper hole. Hole through, 1 1-16" diameter. Foot-stock centre adjustable in vertical plane. Index crank adjustable. Sector arms graduated.

Differential Indexing. Provides for all divisions from 1 to 382. Adjustable Dials. Graduated to thousandths of an inch.

- Tank. Cast in base, capacity 7 gallons. Provision for pump inside frame.
- Vise. Swivels. Base graduated. Jaws hardened, 5 1-8" wide, 1 1-4" deep, open 2 3-4". Floor Space. Right angles to spindle, 76". Parallel to spindle, 83".

Weights. Net, about 2900 lbs.; ready for shipment, about 3350 lbs. Dimensions for shipment, 69" x 37" x 68". Space occupied, about 100 cubic feet.

Equipment. No. 2-S swivel vise, change gears, index plates and tables explaining use of same, 6" 3-jawed chuck, "DD" collet, centre rest, raising block, wrenches and everything else shown in cut.

Price. F.o.b. Providence, R.I. \$ Pump, \$ extra. Counter-shaft, \$ extra.

No. 1D (BACK GEARED) 22 in. x 8 in. x 18 in.

6

UNIVERSAL MILLING MACHINE

Patented Feb. 6, 1900; Nov. 12, 1901; Jan. 13, 1903; July 11, Sept. 5, Dec. 12, 1905; April 30, 1907.



Capacity:

LONGITUDINAL FEED, 22" AUTOMATIC. TRANSVERSE FEED, 8" VERTICAL FEED, 18".

Centres swing 10" in diameter, take 19" in length.

No. 1D (BACK GEARED) 22 in. x 8 in. x 18 in. UNIVERSAL MILLING MACHINE.

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end threaded, 2 1-2" diameter, 4, L.H. Has No. 10 taper hole. Hole through, 21-32" diameter. Drive. Cone, 4 steps, largest 10" diameter. 3" belt. Back gears
- at front. 16 changes of spindle speed in geometrical progression, 21 to 418 revolutions per minute in either direction. Arbor Support. Overhanging arm, solid steel. Both bearings
- clamped with one lever. Centre of spindle to under side of arm, 5 1-2". End of spindle to centre in arbor support, without arm braces, 21 3-4". Bronze bushing for arbor bearing, hole 1 13-16" diameter. Adjustable centre. Arm braces furnished. End of spindle to arbor bushing, with arm braces, 17". Face of column to arm braces, 21 3-4"
- Table. Including oil pans and channels, 41 3-4" x 10 3-4". Working surface, 36 1-4" x 10 3-4". 3 T slots, 5-8" wide. Quick return operated by internal gear and pinion. Arc of swing, 280°. Elevating screw, telescopic. Knee clamped from front. Provision for driving 18" Circular Milling Attachment.
- Feeds. Positive. All spur gears driven by chain. 20 changes in geometrical progression, from .003" to .150" per revolution of spindle. No loose change gears. Changes made by adjustment of index slide and levers. Automatic feed can be used with table set to 50° either side of 0. Feed tripping mechanism, double plunger type. Hand wheels clutched.
- Spiral Head and Foot-stock Centres. Swing 10" diameter; take 19". Head can be set at any angle from 10° below horizontal to 5° beyond perpendicular. Graduated to half degrees. Front end of spindle threaded, 2 1.4" diameter, 4 1-2, R.H. Has No. 10 taper hole. Hole through, 1 1-16" diameter. Foot-stock centre adjustable in vertical plane. Index crank adjustable. Sector arms graduated. Differential Indexing. All divisions from 1 to 382. Adjustable Dials. Graduated to thousandths of an inch.

- Tank. Cast in base; capacity 7 gallons. Provision for pump inside frame.
- Vise. Swivels. Base graduated. Jaws hardened, 6 1-8" wide, 1 9-16" deep, open 3 5-8". Counter-shaft. Driven by one pulley, 14" diameter. 3" belt.
- 230 r.p.m. 2 speeds in either direction obtained by gearing in counter-shaft.
- Floor Space. Right angles to spindle, 77". Parallel to spindle, 79".
- Weights. Net, about 3000 lbs.; ready for shipment, about 3500 lbs. Dimensions for shipment, 60" x 35" x 68", and 50" x 20" x 25". Space occupied, about 83 cubic feet; about 15 cubic feet.

Equipment. No. 3-S swivel vise, change gears, index plates and tables explaining the use of same, 6" 3-jawed chuck, "DD" collet, centre rest, raising block, wrenches and every-

thing else shown in cut, together with overhead works. Price. F.o.b. Providence, R. I. \$ Pump, \$ ex extra.

No. 1AD (BACK GEARED) 22 in. x 8 in. x 18 in.

8

UNIVERSAL MILLING MACHINE.

Constant Speed Drive.

Patented Feb. 6, 1900; Nov. 12, 1901; Jan. 6, Jan. 13, 1903; July 11, Sept. 5, Dec. 12, 1905; April 30, May 28, 1907; July 16, 1912. Others pending.



Capacity:

LONGITUDINAL FEED, 22" | AUTOMATIC. TRANSVERSE FEED, 8" VERTICAL FEED, 18".

Centres swing 10" in diameter, take 19" in length.

No. 1AD (BACK GEARED) 22 in. x 8 in. x 18 in. UNIVERSAL MILLING MACHINE.

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end threaded, 2 1-2" diameter, 4 L.H. Has No. 10 taper hole. Hole through, 21-32" diameter.
- Drive. 1 friction clutch pulley, 11" diameter. 3" belt. Runs on ball bearings, at constant speed, 300 revolutions per minute. Back geared. Ratio of gearing, 1 to 20:1. 16 changes of speed in geometrical progression, 15 to 376 revo-lutions per minute in either direction, obtained by gearing. Reverse within machine. Changes made by adjustment of index slide and levers. Locking device for tumbler gear. Arbor Support. Overhanging arm, solid steel. Both bearings clamped with one lever. Centre of spindle to under side of
- arm, 5 1-2". End of spindle to centre in arbor support, without arm braces, 21 3-4". Bronze bushing for arbor bearing, hole 1 13-16" diameter. Adjustable centre. Arm braces, furnished. End of spindle to arbor bushing, with arm braces, 17". Face of column to arm braces, 21 3-4".
 Table. Including oil pans and channels, 41 3-4" x 10 3-4". Working surface, 36 1-4" x 10 3-4". 3 T slots 5-8" wide. Quick return operated by internal gear and pinion. Arc of swing, 2000 Eleveting group televenic.
- 280°. Elevating screw, telescopic. Knee clamped from front. Provision for driving 18" Circular Milling Attachment.
- Feeds. Positive. All spur gears driven by chain direct. Safety device in gear train. 20 changes in geometrical pro-gression, from 3-10" to 15" per minute. Independent of spin-dle speeds. Range for small mills, .0008" to .040" per rev-olution of spindle; large mills, .020" to 1". No loose change gears. Changes made by adjustment of index slide and hyper to the table soft to levers. Automatic feed can be used with the table set to 50° either side of 0. Feed tripping mechanism, double plunger type. Hand wheels clutched.
- Spiral Head and Foot-stock Centres. Swing 10" diameter; take 19". Head can be set at any angle trom 10° below horizontal to 5° beyond perpendicular. Graduated to half degrees. Front end of spindle threaded, 2 1-4" diameter, 4 1-2 R.H.; has No. 10 taper hole. Hole through, 1 1-16" diameter. Footstock centre adjustable in vertical plane. Index crank adjustable. Sector arms graduated. Differential Indexing. Provides for all divisions from 1 to 382.

Tank. Cast in base; capacity 7 gallons. Provision for pump inside frame.

Adjustable Dials. Graduated to thousandths of an inch.

- Vise. Swivels. Base graduated. Jaws hardened, 6 1-8" wide, 1 9-16" deep, open 3 5-8". Floor Space. Right angles to spindle, 76". Parallel to spin-
- dle, 83".
- Weights. Net about 3150 lbs. Ready for shipment, about 3600 lbs. Dimensions for shipment, 69" x 37" x 68". Space occupied, about 100 cubic feet.
- Equipment. No. 3-S swivel vise, change gears, index plates and tables explaining use of same, 6" 3-jawed chuck, "DD" collet, centre rest, raising block, wrenches and everything else shown in cut.
- Price. F.o.b. Providence, R. I. \$ Pump, \$ extra. Counter-shaft, \$ extra.
- Arbors, Collets, Tapers and Attachments, pages 72 to 123.

No. 2 28 in. x 10 in. x 18 in. UNIVERSAL MILLING MACHINE.

10

Hand or Automatic Vertical Feed.

Patented Feb. 6, 1900; Nov. 12, 1901; Jan. 13, 1903; July 11, Sept. 5, Dec. 12, 1905; April, 30, 1907.



Capacity:

LONGITUDINAL FEED, 28" TRANSVERSE FEED, 10" VERTICAL FEED, 18"

AUTOMATIC. AUTOMATIC. Hand Feed if desired.

Centres swing 10" in diameter, take 27 1-2" in length.

No. 2 28 in. x 10 in. x 18 in. UNIVERSAL MILLING MACHINE.

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end threaded, 2 1-2" diameter, 4, L.H. Has No. 10 taper hole. Hole through, 21-32" diameter. Drive. Cone, 4 steps, largest 10" diameter. 3" belt. Back gears
- at front. 16 changes of spindle speed in geometrical progression, 20 to 418 revolutions per minute in either direction.
- Arbor Support. Overhanging arm, solid steel. Both bearings clamped with one lever. Centre of spindle to under side of arm, 5 1-2". End of spindle to center in arbor support. without arm braces, 23 1-4". Bronze bushing for arbor bear ing, hole 1 13-16" diameter. Adjustable centre. Arm braces furnished. End of spindle to arbor bushing, with arm braces, 18 1-2". Face of column to arm braces, 23 1-4". Table. Including oil pans and channels, 50 1-2" x 10 3-4".
- Working surface, 45"x10 3-4". 3 T slots, 5-8" wide. Quick return operated by internal gear and pinion. Arc of swing, 290°. Elevating screw, telescopic. Knee clamped from front. Provision for driving 18" Circular Milling Attachment.
- Feeds. Positive. All spur gears driven by chain. 20 changes in geometrical progression, from .003" to .150" per revolution of spindle. No loose change gears. Changes made by adjustment of index slide and levers. Automatic feed can be used with table set to 55° either side of 0. Feed tripping mechanism, double plunger type. Hand wheels clutched. Spiral Head and Foot-stock Centres. Swing 10" diameter; take
- 27 1-2". Head can be set at any angle from 10° below horizontal to 5° beyond perpendicular. Graduated to half degrees. Front end of spindle threaded, 2 1.4" diameter, 4 1-2, R.H. Has No. 10 taper hole. Hole through, 1 1-16" diameter. Foot-stock centre adjustable in vertical plane. Index crank adjustable. Sector arms graduated. Differential Indexing. All divisions from 1 to 382.

Adjustable Dials. Graduated to thousandths of an inch.

- Tank. Cast in base; capacity 7 gallons. Provision for pump inside frame.
- Vise. Swivels. Base graduated. Jaws hardened, 6 1-8" wide. 1 9-16" deep, open 3 5-8".
- Counter-shaft. Driven by one pulley, 14" diameter. 3" belt. 230 r.p.m. 2 speeds in either direction obtained by gearing in counter-shaft.
- Floor Space. Right angles to spindle, 91". Parallel to spin-
- dle, 87''. Weights. Net, about 3100 lbs.; ready for shipment, about 3625 Weights. Net, about 3100 lbs.; ready for shipment, 81''x 35''x 68'' and 50''x 20''x 25''. Space occupied, about 84 cubic feet; about 15 cubic feet.
- Equipment. No. 3-S swivel vise, change gears, index plates and tables explaining the use of same, 6" 3-jawed chuck, "DD" collet, centre rest, raising block, wrenches and every-thing else shown in cut, together with overhead works.

Price. F.o.b. Providence, R. I. \$ With Hand Vertical Feed, \$ Pump, \$ extra.

No. 2A 28 in. x 10 in. x 18 in. UNIVERSAL MILLING MACHINE

12

Constant Speed Drive. Hand or Automatic Vertical Feed.

Patented Feb. 6, 1900; Nov. 12, 1901; Jan. 6, Jan. 13, 1903; July 11, Sept. 5, Dec. 12, 1905; April 30, May 28, 1907; July 16, 1912. Others pending.



Capacity:

LONGITUDINAL FEED, 28" TRANSVERSE FEED, 10" VERTICAL FEED, 18"

AUTOMATIC. Hand Feed if desired.

AUTOMATIC.

Centres swing 10" in diameter, take 27 1-2" in length.

No. 2A 28 in. x 10 in. x 18 in. UNIVERSAL MILLING MACHINE.

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end threaded, 2 1-2" diameter, 4, L.H. Has No. 10 taper hole. Hole through, 21-32" diameter.
 Drive. 1 friction clutch pulley, 11" diameter. 3" belt. Runs on ball bearings, at constant speed, 300 revolutions per minute. Beach ground. Partice of meaning is to 2011 16
- minute. Back geared. Ratio of gearing, 1 to 20:1. 16 changes of spindle speed in geometrical progression, 15 to 376 revolutions per minute in either direction. Reverse within machine. Changes made by adjustment of index slide and levers. Locking device for tumbler gear. Arbor Support. Overhanging arm, solid steel. Both bearings
- clamped with one lever. Centre of spindle to under side of arm, 51-2". End of spindle to centre in arbor support, without arm braces, 23 1.4". Bronze bushing for arbor bearing, hole 1 13-16" diameter. Adjustable centre. Arm braces fur-nished. End of spindle to arbor bushing, with arm braces, 18 1-2". Face of column to arm braces, 23 1-4".
- Table. Including oil pans and channels, 50 1-2" x 10 3-4". Working surface, 45" x 10 3-4". 3 T slots, 5-8" wide. Quick return operated by internal gear and pinion. Arc of swing, 290°. Elevating screw, telescopic. Knee clamped from front. Provision for driving 18" Circular Milling Attachment. Feeds. Positive. All spur gears driven by chain. Safety
- device in gear train. 20 changes in geometrical progression, from 3-10" to 15" per minute. Independent of spindle speeds. Range for small mills, .0008" to .040" per revolution of spindle; large mills, .02" to 1". No loose change gears. Changes made by adjustment of index slide and levers. Automatic feed can be used with table set to 55° either side of 0. Feed tripping mechanism, double plunger type. Hand wheels clutched.
- Spiral Head and Foot-stock Centres. Swing 10" diameter; take 27 1-2". Head can be set at any angle from 10° below horizontal to 5° beyond perpendicular. Graduated to half . degrees. Front end of spindle threaded, 2 1-4" diameter, 4 1-2", R.H. Has No. 10 taper hole. Hole through, 1 1-16" diameter. Foot-stock centre adjustable in vertical plane. Index crank adjustable. Sector arms graduated. Differential Indexing. All divisions from 1 to 382. Adjustable Dials. Graduated to thousandths of an inch.

- Tank. Cast in base; capacity 7 gallons. Provision for pump inside frame.
- Vise. Swivels. Base graduated. Jaws hardened, 6 1-8" wide, 1 9-16" deep, open 3 5-8". Floor Space. Parallel to spindle, 92"; at right angles, 91". Weights. Net, about 3200 lbs.; ready for shipment, about
- 3650 lbs. Dimensions for shipment, 69" x 37" x 68". Space occupied, about 100 cubic feet.
- Equipment. No. 3-S swivel vise, change gears, index plates and tables explaining the use of same, 6" 3-jawed chuck, "DD" collet, centre rest, raising block, wrenches and everything else shown in cut.
- Price. F.o.b. Providence, R. I. \$ Pump, \$ extra, With Hand Vertical Feed, \$ Counter-shaft, \$ extra Arbors, Collets, Tapers and Attachments, pages 72 to 123. extra

No. 3 34 in. x 12 in. x 19 in. NIVERSAL MILLING MACHINE

14

Patented Feb. 6, 1900; Nov. 12, 1901; Jan. 13, 1903; July 11, Sept. 5, Dec. 12, 1905; April 30, 1907. Others pending.



Capacity:

LONGITUDINAL FEED, 34" TRANSVERSE FEED, 12" VERTICAL FEED, 19"

AUTOMATIC.

Centres swing 12" in diameter, take 31" in length.

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No. 3 34 in. x 12 in. x 19 in. UNIVERSAL MILLING MACHINE.

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for bronze boxes provided with means of compensation for wear. Front end threaded, 4" diameter, 3, L.H. Has No. 11 taper hole. Recess in end and cap nut for arbor or collet with clutch collar. Hole through, 3-4" diameter.
 Drive. Cone, 4 steps, largest 11 1-2" diameter. 3" belt. Back gears at front. 16 changes of spindle speed direct, in geometrical progression, 13 to 439 revolutions per minute; 8
- reverse, 22 to 305.
- reverse, 22 to 305.
 Arbor Support. Overhanging arm, solid steel. Both bearings clamped with one lever. Centre of spindle to under side of arm, 6 3-8". End of spindle to centre in arbor support, without arm braces, 29 1-4". Bronze bushing for arbor bearing, hole 2 1-16" diameter. Adjustable centre. Arm braces furnished. End of spindle to arbor bushing, with arm braces, 24 1-4". Face of column to arm braces, 26".
 Table. Including oil pans and channels, 57 1-2" x 13". Working surface, 51" x 13". 3 T slots, 5-8" wide. Quick automatic travel of 75" per minute in either direction. Arc of swing, 206°. Elevating screw, telescopic, Knee clamped from from to the statement.
- 296°. Elevating screw, telescopic. Knee clamped from front. Provision for driving 20" Circular Milling Attachment.
- Feeds. Positive. All hardened spur gears driven by chain. 20 changes in geometrical progression, from .004" to .200" per revolution of spindle. No loose change gears. Changes made by adjustment of index slide and levers. Feeds started, stopped and reversed by lever on front of knee. Automatic feed can be used with table set to 58° either side of 0. Feed tripping mechanism, double plunger type. Hand wheels clutched.
- Spiral Head and Foot-stock Centres. Swing 12" diameter; take 31". Head can be set at any angle from 10° below horizontal to 5° beyond perpendicular. Graduated to half degrees. Front end of spindle threaded, 2 1-2" diameter, 4, R.H. Has No. 11 taper hole. Hole through, 1 1-4" diam-eter. Foot-stock centre adjustable in vertical plane. Index crank adjustable. Sector arms graduated. Differential Indexing. All divisions from 1 to 382. Adjustable Dials. Graduated to thousandths of an inch. Tank. Cast in base; capacity 7 1-2 gallons. Provision for

- pump inside frame.
- Vise. Swivels. Base graduated. Jawshardened, 61-8" wide,
- 1 9-16" deep, open 3 5-8".
 Counter-shaft. 3 friction pulleys, 14" diameter. 3 1-2" belts. Speeds: direct, 308 and 120 rev. per minute; reverse, 214.
 Floor Space. Right angles to spindle, 103". Parallel to spin-
- dle, 101".
- Weights. Net, about 4750 lbs.; ready for shipment, 5350 lbs. Dimensions for shipment, 70" x 41" x 72". Space occupied, about 120 cubic feet.
- Equipment. No. 3-S swivel vise, change gears, index plates and tables explaining the use of same, 8" 3-jawed chuck, "G" collet, centre rest, raising block, wrenches and every-thing else shown in cut, together with overhead works.
- Price. F.o.b. Providence, R. I. \$ Pump, \$ ext Arbors, Collets, Tapers and Attachments, pages 72 to 123. extra.

No. 3A 34 in. x 12 in. x 19 in.

UNIVERSAL MILLING MACHINE.

Constant Speed Drive.

Patented Feb. 6, 1900; Nov. 12, 1901; Jan. 6, Jan. 13, 1903; July 11, Sept. 5, Dec. 12, 1905; April 30, May 28, 1907; July 16, 1912. Others pending.



Capacity:

LONGITUDINAL FEED, 34" AUTOMATIC. TRANSVERSE FEED, 12" VERTICAL FEED, 19"

Centres swing 12" in diameter, take 31" in length.

No. 3A 34 in. x 12 in. x 19 in. UNIVERSAL MILLING MACHINE

17

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end threaded, 4" diameter, 3, L.H. Has No. 11 taper hole Hole through, 3-4" diameter. Recess in end and cap nut for arbor or collet with clutch collar.
- Drive. 1 friction clutch pulley, 14" diameter. 4" belt. Runs on ball bearings at constant speed, 320 revolutions per minute. Back geared. Ratio of gearing, 1 to 18.8:1. 16 changes of speed in geometrical progression, 17 to 390 revolutions per minute in either direction. Reverse within machine. Changes made by adjustment of index slide and levers. Locking device for tumbler gear.
- Arbor Support. Overhanging arm, solid steel. Both bearings clamped with one lever. Centre of spindle to under side of arm, 6 3-8". End of spindle to centre in arbor support, without arm braces, 29 1-4". Bronze bushing for arbor bearing, hole 2 1-16" diameter. Adjustable centre. Arm braces furnished. End of spindle to arbor bushing, with arm braces in position, 24 1-4". Face of column to arm braces, 26".
- Table. Including oil pans and channels, 57 1-2" x 13". Working surface, 51" x 13". 3 T slots, 5-8" wide. Quick automatic travel of 75" per minute in either direction. Arc of swing 296°. Elevating screw, telescopic. Knee clamped from front. Provision for driving 20" Circular Milling Attachment.
- Feeds. Positive. All hardened spur gears driven by chain. Safety device in gear train. 20 changes in geometrical pro-gression, from 3-10" to 15" per minute. Independent of spindle speeds. Range for small mills, .00076" to .038" per revolution of spindle; large mills, .0176" to .882". No loose change gears. Changes made by adjustment of index slide and levers. Feeds started, stopped and reversed by lever on front of knee. Automatic feed can be used with table set to any number up to 58° either side of 0. Feed tripping mechanism, double plunger type." Hand wheels clutched.

Spiral Head and Foot-stock Centres. Swing 12" diameter; take 31" length. Head can be set at any angle from 10° below horizontal to 5° beyond perpendicular. Graduated to half degrees. Front end of spindle threaded, 2 1-2" diameter, 4, R.H.; has No.11 taper hole. Hole through, 1 1-4" diameter. Raising block furnished. Foot-stock centre adjustable in vertical plane. Index crank adjustable. Sector arms graduated. Differential Indexing. Provides for all divisions from 1 to 382. Adjustable Dials. Graduated to thousandths of an inch.

Tank. Cast in base, capacity 8 1-2 gallons. Provision for pump inside frame.

Vise. Swivels. Base graduated. Jaws hardened, 6 1-8" wide.

- 19-16" deep, open 3 5-8".
 Floor Space. Parallel to spindle, 110"; at right angles, 104".
 Weights. Net, about 4775 lbs. Ready for shipment, about 5375 lbs. Dimensions for shipment, 76" x 42" x 72". Space occupied, about 133 cubic feet.
- Equipment. No. 3-S swivel vise, change gears, index plates and tables explaining use of same, 8" 3-jawed chuck, "G" collet, centre rest, raising block, wrenches and everything else shown in cut.
- Price. F.o.b. Providence, R. I. \$ Pump, \$ extra Counter-shaft, \$ extra.

Arbors, Collets, Tapers and Attachments, pages 72 to 123.

16



Capacity:

LONGITUDINAL FEED, 34" TRANSVERSE FEED, 12" VERTICAL FEED, 19"

Centres swing 14" in diameter, take 31" in length.

AUTOMATIC.

No. 3A HEAVY 34 in. x 12 in. x 19 in. UNIVERSAL MILLING MACHINE

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for bronze boxes provided with means of compensation for wear. Front end threaded, 4" diameter, 3, L.H. Has No. 11 taper hole. Hole through, 3-4" diameter. Recess in end and cap nut for arbor or collet with clutch collar. Drive. 1 friction clutch pulley, 16" diameter. 5" belt. Runs on ball bearings at constant speed, 320 revolutions per discontent of the speed of the second ball bearings at constant speed, 320 revolutions per
- minute. Back geared. Ratio of gearing, 1 to 20:1. 16 changes of spindle speed in geometrical progression, 16 to 370 revolutions per minute in either direction. Locking device for tumbler gear.
- device for tumbler gear. Arbor Support. Overhanging arm, solid steel. Both bearings clamped with one lever. Centre of spindle to under side of arm, 7 1.4". End of spindle to centre in arbor support, with-out arm braces, 33 1.4". Bronze bushing for arbor bearing, hole 2 5-16" diameter. Adjustable centre. Arm braces fur-nished. End of spindle to arbor bushing, with arm braces in position, 28". Face of column to arm braces, 29 3-4".
- Table. Including oil pans and channels, 60 3-4" x 14 1-2".
 Working surface, 53 3-4" x 14 1-2". 3 T slots, 3-4" wide.
 Quick automatic travel of 82" per minute in either direction. Arc of swing, 280°. Knee clamped from front. Provision for driving 20" Circular Milling Attachment.
- for driving 20" Circular Milling Attachment.
 Feeds. Positive. All hardened spur gears driven by chain.
 Safety device in gear train. 16 changes in geometrical progression, from 5-8" to 20" per minute. Independent of spindle speeds. Range for small mills, .0017" to .054" per revolution of spindle; large mills, .039" to 1.25". An additional series of less than 5-8" per minute provided. No loose gears. Feeds started, stopped and reversed by lever on front of knee. Automatic feed can be used with table set to 50° either side of 0. Freed tripping mechanism double plunger type
- side of 0. Feed tripping mechanism, double plunger type. Spiral Head and Foot-stock Centres. Swing 14" diameter; take 31". Head can be set at any angle from 10° below horizontal to 5° beyond perpendicular. Graduated to half degrees. Front end of spindle threaded, 2 3.4" diameter, 4, R.H. Has No. 11 taper hole. Hole through, 1 1-4". Foot-stock centre adjustable in vertical plane. Index crank adjustable. Sector arms graduated.
- Differential Indexing. All divisions from 1 to 382. Adjustable Dials. Graduated to thousandths of an inch.
- Tank. Castin base; capacity 12 gallons. Provision for pump inside frame.
- Vise. Swivels. Base graduated. Jaws hardened, 7 1-S" wide, 2" deep, open 4 1-2".

Counter-shaft. 2 friction pulleys, 16" diameter. 5" belts. Speed: 320 revolutions per minute in either direction.

- Floor Space. Parallel to spindle, 116"; at right angles, 107". Weights. Net, about 7200 lbs.; ready for shipment, about
- 8100 lbs. Dimensions for shipment, 84" x 47" x 75". Space

occupied, about 172 cubic feet. Equipment. No. 4-S swivel vise, change gears, index plates and tables explaining the use of same, 9" 3-jawed chuck, "G" collet, centre rest, raising block, wrenches and everything else shown in cut, together with overhead works.

Price. F.o.b. Providence, R. I. \$ Pump, \$ extr. Arbors, Collets, Tapers and Attachments, pages 72 to 123. extra.

No. 4A 42 in. x 14 in. x 20 in. UNIVERSAL MILLING MACHINE.

20

Constant Speed Drive.

Patented Feb. 6, 1900; Nov. 12, 1901; Jan. 6, Jan. 13, 1903; July 11, Sept. 5, Dec. 12, 1905; April 30, May 28, 1907; July 16, 1912. Others pending.



Capacity:

LONGITUDINAL FEED, 42" TRANSVERSE FEED, 14" VERTICAL FEED, 20"

AUTOMATIC.

Centres swing 14" in diameter, take 40" in length.

21 No. 4A 42 in. x 14 in. x 20 in. UNIVERSAL MILLING MACHINE.

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end threaded, 4" diameter, 3, L.H. Has No. 11 taper hole. Recess in end and cap nut for arbor or collet with clutch collar. Hole through, 3-4" diameter.
- Drive. 1 friction clutch pulley, 16" diameter. 5" belt. Runs on ball bearings at constant speed, 320 revolutions per minute. Back geared. Ratio of gearing, 1 to 20:1. 16 changes of spindle speed in geometrical progression, 16 to 370 revolutions per minute in either direction. Changes made by adjustment of index slide and levers. Locking device for tumbler gear.
- Arbor Support. Overhanging arm, solid steel. Both bearings clamped with one lever. Centre of spindle to under side of arm, 7 1-4". End of spindle to centre in arbor support, without arm braces, 35 1-4". Bronze bushing for arbor bearing, hole 2 5-16" diameter. Adjustable centre. Arm braces furnished. End of spindle to arbor bushing, with arm braces in position, 30". Face of column to arm braces, 32".
- **Table.** Including oil pans and channels, 70" x 14 1-2". Working surface, 63" x 14 1-2". 3 T slots, 3-4" wide. Quick auto matic travel of 82" per minute in either direction. Arc of swing, 286°. Knee clamped from front. Provision for driving 20" Circular Milling Attachment.
- Feeds. Positive. All hardened spur gears driven by chain. Safety device in gear train. 16 changes in geometrical pro-gression, from 5.8" to 20" per minute. Independent of spin-dle speeds. Range for small mills, .0017" to .054" per revo-lution of spindle; large mills, .039" to 1.25". An additional series of less than 5-8" per minute provided. No loose gears. Feeds started, stopped and reversed by lever on front of knee. Automatic feed can be used with table set to 53° either side of 0. Feed tripping mechanism, double plunger type. Hand wheels clutched.
- Spiral Head and Foot-stock Centres. Swing 14" diameter; take 40". Head can be set at any angle from 10° below horizontal to 5° beyond perpendicular. Graduated to half degrees. Front end of spindle threaded, 2 3.4" diameter, 4, R.H. Has No. 11 taper hole. Hole through, 1 1-4". Foot-stock centre adjustable invertical plane. Index crank adjustable. Sector arms graduated.
- Differential Indexing. All divisions from 1 to 382.
- Adjustable Dials. Graduated to thousandths of an inch.
- Tank. Cast in base; capacity 12 gallons. Provision for pump inside frame.
- Vise. Swivels. Base graduated. Jaws hardened, 7 1-8" wide, 2" deep, open 4 1-2".
- Counter-shaft. 2 friction pulleys, 16" diameter. 5" belt. Speed: 320 revolutions per minute in either direction.
- Floor Space. Parallel to spindle, 125"; at right angles, 124".
 Weights. Net, about 7250 lbs.; ready for shipment, about 8100 lbs. Dimensions for shipment, 86" x 48" x 75". Space occupied, about 180 cubic feet.
- Equipment. No. 4-S swivel vise, change gears, index plates and tables, 9" 3-jawed chuck, "G" collet, centre rest, raising block, wrenches and everything else shown in cut, together with overhead works.
- Pump, \$ Price. F.o.b. Providence, R. I. \$ extra. Arbors, Collets, Tapers and Attachments, pages 72 to 123.

No. 4A HEAVY 42 in. x 14 in. x 20 in. UNIVERSAL MILLING MACHINE. Constant Speed Drive.

Patented Feb. 6, 1900; Nov. 12, 1901; Jan. 6, Jan. 13, 1903; July 11, Sept. 5, Dec. 12, 1905; April 30, May 28, 1907; July 16, 1912. Others pending.



Capacity:

LONGITUDINAL FEED, 42" TRANSVERSE FEED, 14" AUTOMATIC. VERTICAL FEED, 20"

Centres swing 15" in diameter, take 41 1-2" in length.

No. 4A HEAVY 42 in. x 14 in. x 20 in. UNIVERSAL MILLING MACHINE.

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end threaded, 4 1-2" diameter, 2 3-4, L.H. Has No. 12 taperhole. Hole through, 3-4" diameter. - Recess in end and cap nut for arbor or collet with clutch collar. Drive. 1 friction clutch pulley, 18" diameter. 6" belt. Runs on
- ball bearings, at constant speed, 320 revolutions per minute. Back geared. Ratio of gearing, 1 to 21.3:1. 16 changes of speed in geometrical progression, 15 to 350 revolutions per
- speed in geometrical progression, 15 to 350 revolutions per minute in either direction. Changes made by adjustment of index slide and levers. Locking device for tumbler gear.
 Arbor Support: Overhanging arm, solid steel. Both bearings clamped with one wrench. Centre of spindle to under side of arm, 8 3-8". End of spindle to centre in arbor support, without arm braces, 35". Bronze bushing for arbor bearing, hole 2 9-16" diameter. Adjustable centre. Arm support furnished. End of spindle to arbor bushing, with arm braces in position, 29 3-4". Face of column to arm braces, 31 1-2".
 Table. Including oil pans and channels, 72" x 17 1-2". Working surface, 64 1-2" x 17 1-2". 3 T slots, 3-4" wide. Quick automatic travel of 82" per minute in either direction. Arc of swing, 286°. Elevating screw, telescopic. Knee clamped from front. Provision for driving 20"Circular Milling Attachment.
 Feeds. Positive. All-hardened spur gears driven by chain.
- front. Provision for driving 20" Circular Milling Attachment.
 Feeds. Positive. All-hardened spur gears driven by chain. Safety device in gear train. 16 changes in geometrical progression, from 5.8" to 20" per minute. Independent of spin-dle speeds. Range for small mills, .0018" to .057" per revolu-tion of spindle; large mills, .041" to 1.33". An additional series of less than 5.8" per minute provided. No loose change gears. Feeds started, stopped and reversed by lever on front of knee. Automatic feed can be used with table set to 53° either side of 0. Feed tripping mechanism, double plunger type. Hand wheels clutched.
 Spiral Head and Foot-stock Centres. Swing 15" diameter:
- Spiral Head and Foot-stock Centres. Swing 15" diameter; take 41 1-2". Head can be set at any angle from 10° below horizontal to 5° beyond perpendicular. Front end of spindle threaded, 2 3-4" diameter, 4, R.H. Has No. 12 taper hole. Hole through, 1 1-2" diameter. Graduated to half degrees. Foot-stock centre adjustable in vertical plane. Index crank adjustable. Sector arms graduated. Differential Indexing. All divisions from 1 to 382. Adjustable Dials. Graduated to thousandths of an inch.

- Tank. Cast in base; capacity 14 gallons. Provision for pump inside frame.
- Vise. Swivels. Base graduated. Jaws hardened, 7 1-8" wide, 2" deep, open 4 1.2". Counter-snaft. 2 friction pulleys, 18" diameter. 6" belt. Speed:
- 320 revolutions per minute in either direction.

- Floor Space. Parallel to spindle, 130"; at right angles, 124". Weights. Net, about 9500 lbs.; ready for shipment, about 10,400 lbs. Dimensions for shipment, 92" x 53" x 78". Space occupied, about 220 cubic feet.
- Equipment. No. 4-S swivel vise, change gears, index plates and tables, 9" 3-jawed chuck,"T" collet, centre rest, raising block, wrenches and everything else shown in cut.
- Price. F.o.b. Providence, R. I. S Pump S extr Arbors, Collets, Tapers and Attachments, pages 72 to 123. extra.

24 No. 00 7 in. x 4 1-4 in. x 7 1-2 in. HAND MILLING MACHINE. All Hand Feeds. 41.00 Capacity: LONGITUDINAL FEED, 7". TRANSVERSE FEED, 4 1-4".

VERTICAL FEED, 7 1-2".

No. 00 7 in. x 4 1-4 in. x 7 1-2 in. HAND MILLING MACHINE. All Hand Feeds.

25

Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end has No. 9 taper hole. Hole through, 17-32".

- Drive. Cone, 4 steps, largest 9" diameter. 2" belt. 4 changes of spindle speed direct and 4 reverse, 125 to 500 revolutions per minute.
- Arbor Support. Overhanging arm, solid steel. Centre of spindle to under side of arm, 5 1-8". Adjustable centre an integral part. Greatest distance, end of spindle to centre in arbor support, 10 1-2".
- Table. Including oil pans and channels, 20" x 7 1-2". Working surface, 16" x 5 1-4". 1 T slot, 5-8" wide.
- Feeds. Longitudinal, 7". Extreme throw of lever at any setting gives a longitudinal feed of 4 1-4". Transverse, 4 1-4". Vertical, 7 1-2". Extreme throw of lever at any setting gives a vertical feed of 3 1-2".

Adjustable Dial. Graduated to thousandths of an inch. For transverse movement.

Vise. Flanged. Jaws hardened, 4 1-8" wide, 1 1-16" deep, open 2".

Counter-shaft. 2 friction pulleys, 8" diameter. 2 1-4" belts. Speed: 250 revolutions per minute in either direction.

Floor Space. Right angles to spindle, 36". Parallel to spindle, 36".

Weights. Net, about 1000 lbs.; ready for shipment, about 1250 lbs. Dimensions for shipment, 41" x 29" x 60". Space occupied, about 41 cubic feet.

Equipment. No. 1-F flanged vise, oil can, "C" collet, wrenches and everything else shown in cut, together with overhead works.

Price. F.o.b. Providence, R. I. \$

No. 0 18 in. x 6 in. x 15 in. PLAIN MILLING MACHINE. Screw Feed. Patented Jan. 13, 1903.

26

Capacity:

LONGITUDINAL FEED, 18", AUTOMATIC. TRANSVERSE FEED, 6". VERTICAL FEED, 15".

No. 0 18 in. x 6 in. x 15 in. PLAIN MILLING MACHINE.

Screw Feed.

Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end has No. 9 taper hole. Hole through, 17-32".

- Drive. Cone, 4 steps, largest 10" diameter. 2 1-4" belt. 4 changes of spindle speed direct and 4 reverse, 115 to 460 revolutions per minute.
- Arbor Support. Overhanging arm, solid steel. Centre of spindle to under side of arm, 5 1-8". Adjustable centre an integral part. Greatest distance, end of spindle to centre in arbor support, 12 1-2".
- Table. Including oil pans and channels, 29 1-4" x 8 13-16". Working surface, 22 1-2" x 8 13-16". 3 T slots, 5-8" wide. Quick return operated by internal gear and pinion.
- Feeds. 8 changes, from .005" to .11". Longitudinal, automatic, 18". Transverse, 6". Vertical, 15".
- Adjustable Dials. Graduated to thousandths of an inch.
- Tank. Cast in base; capacity 3 1-2 gallons. Provision for pump inside frame.

Vise. Swivels. Base graduated. Jaws hardened, 51-8" wide, 1 1-4" deep, open 2 3-4".

- Counter-shaft. 2 friction pulleys, 10" diameter. 3" belts. Speed: 230 revolutions per minute in either direction.
- Floor Space. At right angles to spindle, 60". Parallel to spindle, 38".

Weights. Net, about 1200 lbs.; ready for shipment, about 1450 lbs. Dimensions for shipment, 41" x 29" x 63". Space occupied, about 43 cubic feet.

- Equipment. No. 2-S swivel vise, oil can, "KK" collet, wrenches and everything else shown in cut, together with overhead works.
- Price. F.o.b. Providence, R. I. \$ Pump, \$ extra. Arbors, Collets, Tapers and Attachments, pages 72 to 123.

27



LONGITUDINAL FEED, 18", AUTOMATIC. TRANSVERSE FEED, 6". VERTICAL FEED, 15".

No. OY 18 in. x 6 in. x 15 in. PLAIN MILLING MACHINE. Rack Feed.

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end has No.9 taper hole. Hole through, 17-32".
- Drive. Cone, 4 steps, largest 10" diameter. 2 1-4" belt. 4 changes of spindle speed direct and 4 reverse, 115 to 460 revolutions per minute.
- Arbor Support. Overhanging arm, solid steel. Centre of spindle to under side of arm, 5 1-8". Adjustable centre an integral part. Greatest distance, end of spindle to centre in arbor support, 12 1-2".
- Table. Including oil pans and channels, 29" x 8 13-16".
 Working surface, 22 1-2" x 8 13-16". 3 T slots, 5-8" wide.
 Quick return by crank on front of knee.
- Feeds. 8 changes, from .005" to .11". Longitudinal, automatic, 18". Transverse, 6". Vertical, 15".
- Adjustable Dials. Graduated to thousandths of an inch. For transverse and vertical movements.
- Tank. Cast in base; capacity 3 1-2 gallons. Provision for pump inside frame.
- Vise. Flanged. Jaws hardened, 4 1.8" wide, 1 1-16" deep, open 2".
- Counter-shaft. 2 friction pulleys, 10" diameter. 3" belts. Speed: 230 revolutions per minute in either direction.
- Floor Space. At right angles to spindle, 47". Parallel to spindle, 38".
- Weights. Net, about 1100 lbs.; ready for shipment, about 1350 lbs. Dimensions for shipment, 41" x 29" x 63". Space occupied, about 43 cubic feet.
- Equipment. No. 1-F flanged vise, oil can, "KK" collet, wrenches and everything else shown in cut, together with overhead works.
- Price. F.o.b. Providence, R. I. \$ Pump, \$ extra. Arbors, Collets, Tapers and Attachments, pages 72 to 123.

No. 1 22 in. x 8 in. x 19 in.

PLAIN MILLING MACHINE.

Patented Feb. 6, 1900; Jan. 13, 1903; July 11, Dec. 12, 1905.



Capacity:

LONGITUDINAL FEED, 22" { AUTOMATIC TRANSVERSE FEED, 8" VERTICAL FEED, 19".

No. 1 22 in. x 8 in. x 19 in. PLAIN MILLING MACHINE.

31

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end threaded, 2 1-2" diameter, 4, L.H. Has No. 10 taper hole. Hole through, 21-32" diameter.
- Drive. Cone, 5 steps, largest 10 3-4" diameter. 3" belt. 10 changes of spindle speed direct, in geometrical progression, 61 to 430 revolutions per minute; 5 reverse, 68 to 389 revolutions per minute.
- Arbor Support. Overhanging arm, solid steel. Both bearings clamped with one lever. Centre of spindle to under side of arm, 5 1-2". End of spindle to centre in arbor support, without arm braces, 21 3-4". Bronze bushing for arbor bearing, hole 1 13-16" diameter. Adjustable centre. Arm braces furnished. End of spindle to arbor bushing, with arm braces, 17". Face of column to arm braces, 21 3-4".
- Table. Including oil pans and channels, 42 3-4" x 11 1-2". Working surface, 37" x 11 1-2". 3 T slots, 5-8" wide. Quick return operated by internal gear and pinion. Elevating screw, telescopic. Knee clamped from front. Provision for driving 18" Circular Milling Attachment.
- Feeds. Positive. All spur gears driven by chain. 20 changes in geometrical progression, from .003" to .150" per revolution of spindle. No loose change gears. Changes made by adjustment of index slide and levers. Feed tripping mechanism, double plunger type. Hand wheels clutched.

Adjustable Dials. Graduated to thousandths of an inch.

- Tank. Cast in base; capacity 7 gallons. Provision for pump inside frame.
- Vise. Swivels. Base graduated. Jaws hardened, 5 1-8" wide, 1 1-4" deep, open 2 3-4".
- **Counter-shaft.** 3 friction pulleys, 12" diameter. 3 1-2" belts. Speeds: direct, 147 and 180 revolutions per minute; reverse, 163.
- Floor Space. At right angles to spindle, 80". Parallel to spindle, 61 1-2".
- Weights. Net, about 2730 lbs.; ready for shipment, about 3200 lbs. Dimensions for shipment, 60" x 34" x 68". Space occupied about 80 cubic feet.
- Equipment. No.2-S swivel vise, oil can, "E" collet, wrenches and everything else shown in cut, together with overhead works.
- Price. F.o.b. Providence, R. I. \$ Pump, \$ extra. Arbors, Collets, Tapers and Attachments, pages 72 to 123.

30



Capacity:

LONGITUDINAL FEED, 24", AUTOMATIC. TRANSVERSE FEED, 6 1-2". VERTICAL FEED, 18 1-2".

No. 1Y

24 in. x 6 1-2 in. x 18 1-2 in. PLAIN MILLING MACHINE.

Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end threaded, 2 1-2" diameter, 4, L.H. Has No. 10 taper hole. Hole through, 21-32" diameter.

Drive. Cone, 5 steps, largest 10 3-4" diameter. 3" belt. With 1 speed of counter-shaft, 5 changes of spindle speed direct and 5 reverse, 68 to 389 revolutions per minute, or with 2 speeds, 10 direct, from 61 to 430 revolutions per minute. Speeds in geometrical progression.

Arbor Support. Overhanging arm, solid steel. Both bearings clamped with one lever. Centre of spindle to under side of arm, 5 1-2". End of spindle to centre in arbor support, without arm braces, 17". Bronze bushing for arbor bearing, hole 1 13-16" diameter. Adjustable centre. Arm braces furnished. End of spindle to arbor bushing, with arm braces, 12". Face of column to arm braces, 17 1-4".

Table. Including oil pans and channels, 38" x 10". Working surface, 32" x 10". 3 T slots, 5-8" wide. Elevating screw, telescopic. Quick return operated by crank on front of knee.

Feeds. 8 changes in geometrical progression, from .007" to .12" per revolution of spindle.

Adjustable Dials. Graduated to thousandths of an inch. For transverse and vertical movements.

Tank. Cast in base, capacity 7 gallons. Provision for pump inside frame.

Vise. Flanged. Jaws hardened, 5 1-8" wide, 1 1-4" deep, open 2 3-4".

Counter-shaft. 2 friction pulleys, 12" diameter. 3" belts. Speeds: 163 revolutions per minute in either direction, or direct, 147 and 180.

Floor Space. At right angles to spindle, 62". Parallel to spindle, 51".

Weights: Net, about 2075 lbs.; ready for shipment, about 2425 lbs. Dimensions for shipment, 53"x 34"x 67". Space occupied, about 70 cubic feet.

Equipment. No. 2-F flanged vise, oil can, "E" collet, wrenches and everything else shown in cut, together with overhead works.

Price. F.o.b. Providence, R. I. \$ Pump, \$ extra. Arbors, Collets, Tapers and Attachments, pages 72 to 123.

33

No. 1B 22 in. x 8 in. x 19 in. PLAIN MILLING MACHINE.

34

Constant Speed Drive.

Patented Feb. 6, 1900; Jan. 6, Jan. 13, 1903; July 11, Dec. 12, 1905; May 28, 1907. Others pending.



Capacity:

LONGITUDINAL FEED, 22" AUTOMATIC TRANSVERSE FEED, 8" VERTICAL FEED, 19".

No. 1B 22 in. x 8 in. x 19 in. PLAIN MILLING MACHINE.

35

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end threaded, 2 1-2" diameter, 4, L.H. Has No. 10 taper hole. Hole through, 21-32" diameter.
- Drive. 1 friction clutch pulley, 11" diameter. 3" belt. Runs on ball bearings at constant speed, 300 revolutions per minute. Can be driven direct from main line. Ratio of gearing, .7 to 7.3:1. 12 changes of speed in geometrical progression, 41 to 427 revolutions per minute, in either direction. Reverse within machine. Changes made by adjustment of index slide and levers. Locking device for tumbler gear.
- Arbor Support. Overhanging arm, solid steel. Both bearings clamped with one lever. Centre of spindle to under side of arm, 5 1-2". End of spindle to centre in arbor support, without arm braces, 21 3-4". Bronze bushing for arbor bearing, hole 1 13-16". Adjustable centre. Arm braces furnished. End of spindle to arbor bushing, with arm braces, 17". Face of column to arm braces, 21 3-4".
- Table. Including oil pans and channels, 42 3-4" x 11 1-2". Working surface, 37" x 11 1-2". 3 T slots, 5-8" wide. Quick return operated by internal gear and pinion. Elevating screw, telescopic. Knee clamped from front. Provision for driving 18" Circular Milling Attachment.
- Feeds. Positive. All spur gears driven by chain direct. Safety device in gear train. 20 changes in geometrical progression, from 3-10" to 15" per minute. Independent of spindle speeds. Range for small mills, .0007" to .035" per revolution of spindle; large mills, .0073" to .366". No loose change gears. Changes made by adjustment of index slide and levers. Feed tripping mechanism, double plunger type. Hand wheels clutched.

Adjustable Dials. Graduated to thousandths of an inch.

- Tank. Cast in base; capacity 7 gallons. Provision for pump inside frame.
- Vise. Swivels. Base graduated. Jaws hardened, 5 1-8" wide, 1 1-4" deep, open 2 3-4".
- Floor Space. At right angles to spindle, 78". Parallel to spindle, 67".
- Weights. Net, about 2750 lbs. Ready for shipment, about 3250 lbs. Dimensions for shipment, 67" x 35" x 68". Space occupied, about 92 cubic feet.
- Equipment. No. 2-S swivel vise, oil can, "E" collet, wrenches and everything else shown in cut.

Price. F.o.b. Providence, R. I. \$ Pump, \$ extra. Countershaft, \$ extra.

No. 1D (BACK GEARED) 22 in. x 8 in. x 19 in.

36

PLAIN MILLING MACHINE.

Patented Feb. 6, 1900; Jan. 13, 1903; July 11, Dec. 12, 1905.



Capacity:

LONGITUDINAL FEED, 22" AUTO TRANSVERSE FEED, 8" VERTICAL FEED, 19".

No. 1D (BACK GEARED) 22 in. x 8 in. x 19 in. PLAIN MILLING MACHINE.

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end threaded, 2 1-2" diameter, 4, L.H. Has No. 10 taper hole. Hole through, 21-32" diameter.
- Drive. Cone, 4 steps, largest 10" diameter. 3" belt. Back gears at front. 16 changes of spindle speed direct, in geometrical progression, 21 to 418 revolutions per minute; 8 reverse, 23 to 382 revolutions per minute.
- Arbor Support. Overhanging arm, solid steel. Both bearings clamped with one lever. Centre of spindle to under side of arm, 5 1-2". End of spindle to centre in arbor support, without arm braces, 21 3-4". Bronze bushing for arbor bearing, hole 1 13-16" diameter. Adjustable centre. Arm braces furnished. End of spindle to arbor bushing, with arm braces, 17". Face of column to arm braces, 21 3-4".
- Table. Including oil pans and channels, 42 3-4" x 11 1-2". Working surface, 37" x 11 1-2". 3 T slots, 5-8" wide. Quick return operated by internal gear and pinion. Elevating screw, telescopic. Knee clamped from front. Provision for driving 18" Circular Milling Attachment.
- Feeds. Positive. All spur gears driven by chain. 20 changes in geometrical progression, from .003" to .150" per revolution of spindle. No loose change gears. Changes made by adjustment of index slide and levers. Feed tripping mechanism, double plunger type. Hand wheels clutched.

Adjustable Dials. Graduated to thousandths of an inch.

Tank. Cast in base; capacity 7 gallons. Provision for pump inside frame.

- Vise. Swivels. Base graduated. Jaws hardened, 6 1-8" wide, 1 9-16" deep, open 3 5-8".
- Counter-shaft. 3 friction pulleys, 12" diameter. 3 1-2" belts. Speeds: direct, 190 and 230 revolutions per minute; reverse, 210.
- Floor Space. Right angles to spindle, 78". Parallel to spindle, 61".
- Weights. Net, about 2900 lbs.; ready for shipment, about 3350 lbs. Dimensions for shipment, 60" x 34" x 68". Space occupied, about 80 cubic feet.
- Equipment. No. 3-S swivel vise, oil can, "E" collet, wrenches and everything else shown in cut, together with overhead works.
- Price. F.o.b. Providence, R. I. \$ Pump, \$ extra. Arbors, Collets, Tapers and Attachments, pages 72 to 123.

No. 1BD (BACK GEARED)

38

22 in. x 8 in. x 19 in.

PLAIN MILLING MACHINE.

Constant Speed Drive.

Patented Feb. 6, 1900; Jan. 6, Jan. 13, 1903; July 11, Dec. 12, 1905; May 28, 1907. Others pending.



Capacity:

LONGITUDINAL FEED, ^{22"} AUTOMATIC. TRANSVERSE FEED, ^{8"} VERTICAL FEED, ^{19"}.

No. 1BD (BACK GEARED) 22 in. x 8 in. x 19 in.

39

PLAIN MILLING MACHINE.

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end threaded, 2 1-2" diameter, 4, L.H. Has No. 10 taper hole. Hole through, 21-32" diameter.
- Drive. 1 friction clutch pulley, 11" diameter. 3" belt. Runs on ball bearings at constant speed, 300 revolutions per minute. Can be driven direct from main line. Back geared Ratio of gearing, 1 to 20:1. 16 changes of speed in geometrical progression, 15 to 376 revolutions per minute, in either direction; obtained by gearing. Reverse within machine. Changes made by adjustment of index slide and levers. Locking device for tumbler gear.
- Arbor Support. Overhanging arm, solid steel. Both bearings clamped with one lever. Centre of spindle to under side of arm, 5 1-2". End of spindle to centre in arbor support, without arm braces, 21 3-4". Bronze bushing for arbor bearing, hole 1 13-16". Arm braces furnished. Adjustable centre. End of spindle to arbor bushing, with arm braces, 17". Face of column to arm braces, 21 3-4".
- Table. Including oil pans and channels, 42 3-4" x 11 1-2". Working surface, 37" x 11 1-2". 3 T slots, 5-8" wide. Quick return operated by internal gear and pinion. Elevating screw, telescopic. Knee clamped from front. Provision for driving 18" Circular Milling Attachment.
- Feeds. Positive. All spur gears driven by chain direct. Safety device in gear train. 20 changes in geometrical progression, from 3-10" to 15" per minute. Independent of spindle speeds. Range for small mills, .0008" to .040" per revolution of spindle; large mills, .020" to 1". No loose change gears. Changes made by adjustment of index slide and levers. Feed tripping mechanism, double plunger type. Hand wheels clutched.

Adjustable Dials. Graduated to thousandths of an inch.

- Tank. Cast in base; capacity 7 gallons. Provision for pump inside frame.
- Vise. Swivels. Base graduated. Jawshardened, 6 1-8" wide, 1 9-16" deep, open 3 5-8".
- Floor Space. Right angles to spindle, 78". Parallel to spindle, 67".
- Weights. Net, about 3100 lbs. Ready for shipment, about 3600 lbs. Dimensions for shipment, 67" x 35" x 68". Space occupied, about 92 cubic feet.
- Equipment. No. 3-S swivel vise, "E" collet, oil can, wrenches and everything else shown in cut.
- Price. F.o.b. Providence, R. I. \$ Pump, \$ extra. Counter-shaft, \$ extra.

No. 2 28 in. x 10 in. x 19 in.

40 .

PLAIN MILLING MACHINE.

Hand or Automatic Transverse and Vertical Feeds.

Patented Feb. 6, 1900; Jan. 13, 1903; July 11, Dec. 12, 1905.

Capacity:

LONGITUDINAL FEED, 28", A TRANSVERSE FEED, 10" A VERTICAL FEED, 19" H

AUTOMATIC. AUTOMATIC. Hand Feed if desired.

No. 2 28 in. x 10 in. x 19 in. PLAIN MILLING MACHINE.

Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end threaded, 2 1-2" diameter, 4, L.H. Has No. 10 taper hole. Hole through, 21-32".

- Drive. Cone, 4 steps, largest 10" diameter. 3" belt. Back gears at front. 16 changes of spindle speed direct, in geometrical progression, 21 to 418 revolutions per minute; 8 reverse, 23 to 382 revolutions per minute.
- Arbor Support. Overhanging arm, solid steel. Both bearings clamped with one lever. Centre of spindle to under side of arm, 5 1-2". End of spindle to centre in arbor support, without arm braces, 23 1-4". Bronze bushing for arbor bearing, hole 1 13-16" diameter. Adjustable centre. Arm braces furnished. End of spindle to arbor bushing, with arm braces, 18 1-2". Face of column to arm braces, 23 1-4".
- Table. Including oil pans and channels, 49 1-2" x 11 1-2". Working surface, 44° x 11 1-2". 3 T slots, 5-8" wide. Quick return operated by internal gear and pinion. Elevating screw, telescopic. Knee clamped from front. Provision for driving 18" Circular Milling Attachment.
- Feeds. Positive. All spur gears driven by chain. 20 changes in geometrical progression, from .003" to .150" per revolution of spindle. No loose change gears. Changes made by adjustment of index slide and levers. Feed tripping mechanism, double plunger type. Hand wheels clutched.

Adjustable Dials. Graduated to thousandths of an inch.

- Tank. Cast in base; capacity 7 gallons. Provision for pump inside frame.
- Vise. Swivels. Base graduated. Jaws hardened, 6 1-8" wide, 1 9-16" deep, open 3 5-8".
- **Counter-shaft.** 3 friction pulleys, 12" diameter. 3 1-2" belts. Speeds: direct, 190 and 230 revolutions per minute; reverse, 210.
- Floor Space. At right angles to spindle, 90". Parallel to spindle, 63".
- Weights. Net, about 3050 lbs.; ready for shipment, about 3550 lbs. Dimensions for shipment, 60"x 34"x 68". Space occupied, about 80 cubic feet.

Equipment. No. 3-S swivel vise, "E" collet, wrenches and everything shown in cut, together with overhead works.

Price. F.o b. Providence, R. I. \$ Pump, \$ extra. With Hand Transverse and Vertical Feeds, \$


Capacity:

LONGITUDINAL FEED, 28", AUTOMATIC. TRANSVERSE FEED, 6 1-2". VERTICAL FEED, 18 1-2".

No. 2Y 28 in. x 6 1-2 in. x 18 1-2 in. PLAIN MILLING MACHINE.

Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end threaded, 2 1-2" diameter, 4, L.H. Has No. 10 taper hole. Hole through, 21-32" diameter.

Drive. Cone, 4 steps, largest 10" diameter. 3" belt. Back gears at front. 8 changes of spindle speed in either direction, 23 to 382 revolutions per minute, or 16 direct, 21 to 418. Speeds in geometrical progression.

Arbor Support. Overhanging arm, solid steel. Both bearings clamped with one lever. Centre of spindle to under side of arm, 5 1-2". End of spindle to centre in arbor support without arm braces, 17". Bronze bushing for arbor bearing, hole 1 13-16" diameter. Adjustable centre. Arm braces furnished. End of spindle to arbor bushing, with arm braces, 12". Face of column to arm braces, 17 1-4".

Table. Including oil pans and channels, 40" x 10 1-4". Work ing surface, 34" x 10 1-4". 3 T slots, 5-8" wide. Quick return by crank on front of knee. Elevating screw, telescopic.

Feeds. 12 changes in geometrical progression, from .006" to .130".

Adjustable Dials. Graduated to thousandths of an inch. For transverse and vertical movements.

Tank. Cast in base; capacity 7 gallons. Provision for pump inside frame.

Vise. Flanged. Jaws hardened, 6 1-8" wide, 1 9-16" deep, open 3 5-8".

Counter-shaft. 2 friction pulleys, 14" diameter, 3 1-2" belts. Speeds: 210 revolutions per minute in either direction; or direct, 190 and 230.

Floor Space. Right angles to spindle, 68". Parallel to spindle, 51".

Weights. Net, about 2450 lbs.; ready for shipment, about 2815 lbs. Dimensions for shipment, 53" x 34" x 67". Space occupied, about 70 cubic feet.

Equipment. No. 3-F flanged vise, oil can, "E" collet, wrenches and everything else shown in cut, together with overhead works.

Price. F.o.b. Providence, R. I. \$ Pump, \$ extra. Arbors, Collets, Tapers and Attachments, pages 72 to 123.

No. 2B

44

28 in. x 10 in. x 19 in.

PLAIN MILLING MACHINE.

Constant Speed Drive. Hand or Automatic Transverse and Vertical Feeds.

Patented Feb. 6, 1900; Jan. 6, Jan. 13, 1903; July 11, Dec. 12, 1905; May 28, 1907; July 16, 1912. Others pending.



Capacity:

LONGITUDINAL FEED, 28", AUTOMATIC. TRANSVERSE FEED, 10" AUTOMATIC. VERTICAL FEED, 19" Hand Feed if desired.

No. 2B 28 in. x 10 in. x 19 in. PLAIN MILLING MACHINE.

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end threaded, 2 1-2" diameter, 4, L.H. Has No. 10 taper hole. Hole through, 21-32" diameter.
- Drive. 1 friction clutch pulley, 11" diameter. 3" belt. Runs on ball bearings at constant speed, 300 revolutions per minute. Can be driven direct from main line. Back geared. Ratio of gearing, 1 to 20:1. 16 changes of speed in geometrical progression, 15 to 376 revolutions per minute in either direction, obtained by gearing. Reverse within machine. Changes made by adjustment of index slide and levers. Locking device for tumbler gear.
- Arbor Support. Overhanging arm solid steel. Both bearings clamped with one lever. Centre of spindle to under side of arm, 5 1-2". End of spindle to centre in arbor support, without arm braces, 23 1-4". Bronze bushing for arbor bearing, hole 1 13-16". Adjustable centre. Arm braces furnished. End of spindle to arbor bushing, with arm braces, 18 1-2". Face of column to arm braces, 23 1-4".
- Table. Including oil pans and channels, 49 1-2" x 11 1-2". Working surface, 44" x 11 1-2". 3 T slots, 5-8" wide. Quick return operated by internal gear and pinion. Elevating screw, telescopic. Knee clamped from front. Provision for driving 18" Circular Milling Attachment.
- Feeds. Positive. All spur gears driven by chain direct. Safety device in gear train. 20 changes, in geometrical progression, from 3-10" to 15" per minute. Independent of spindle speeds. Range for small mills, .0008" to .040" per revolution of spindle; large mills, .020" to 1". No loose change gears. Changes made by adjustment of index slide and levers. Feed tripping mechanism, double plunger type. Hand wheels clutched.
- Tank. Cast in base, capacity 7 gallons. Provision for pump inside frame.
- Adjustable Dials. Graduated to thousandths of an inch.
- Vise. Swivels. Base graduated. Jaws hardened, 6 1-8" wide, 1 9-16" deep, open 3 5-8".
- Floor Space. At right angles to spindle, 90". Parallel to spindle, 68".
- Weights. Net, about 3050 lbs. Ready for shipment, about 3550 lbs. Dimensions for shipment, 67"x 35"x 68". Space occupied, about 92 cubic feet.
- Equipment. No. 3-S swivel vise, "E" collet, oil can, wrenches and everything else shown in cut.

Price. F.o.b. Providence, R. I. \$ With Hand Transverse and Vertical Feeds, \$ Pump. \$ extra.

Pump, \$ extra. Counter-shaft, \$ extra.

Arbors, Collets, Tapers and Attachments, pages 72 to 123.

No. 2B HEAVY

46

28 in. x 10 in. x 19 in.

PLAIN MILLING MACHINE.

Constant Speed Drive.

Patented Feb. 6, 1900; Jan. 6, Jan. 13, 1903; July 11, Dec. 12, 1905; May 28, 1907; July 16, 1912. Others pending.



Capacity:

LONGITUDINAL FEED, 28" TRANSVERSE FEED, 10" VERTICAL FEED, 19"

AUTOMATIC.

No. 2B HEAVY 28 in. x 10 in. x 19 in. PLAIN MILLING MACHINE.

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end threaded, 4" diameter, 3, L.H. Has No. 11 taper hole. Hole through, 3-4" diameter. Recess in end and cap nut for arbor or collet with clutch collar.
- Drive. 1 friction clutch pulley, 14" diameter. 4" belt. Runs on ball bearings at constant speed, 320 revolutions per minute. Can be driven direct from main line. Back geared. Ratio of gearing, 1 to 18.8:1. 16 changes of spindle speed in geometrical progression, 17 to 390 revolutions per minute in either direction. Reverse within machine. Changes made by adjustment of index slide and levers.
- Arbor Support. Overhanging arm, solid steel. Both bearings clamped with one lever. Centre of spindle to under side of arm, 6 3-8". End of spindle to centre in arbor support, without arm braces, 27 1-2". Bronze bushing for arbor bearing, 2 1-16" diameter. Adjustable centre. Arm braces furnished. End of spindle to arbor bushing in arm braces, 22 1-2". Face of column to arm braces, 24 1-2".
- Table. Including oil pans and channels, 51 1-2" x 14 9-16". Working surface, 45" x 14 9-16". 3 T slots, 5-8" wide. Quick automatic travel of 75" per minute in either direction. Elevating screw, telescopic. Knee clamped from front. Provision for driving 20" Circular Milling Attachment.
- Feeds. Positive. All hardened spur gears driven by chain direct. Safety device in gear train. 20 changes in geometrical progression, from 3-10" to 15" per minute. Independent of spindle speeds. Range for small mills, .0008" to .038" per revolution of spindle; large mills, .0176" to .882". No loose change gears. Changes made by adjustment of index slide and levers. Feeds started, stopped and reversed by lever on front of knee. Feed tripping mechanism, double plunger type. Hand wheels clutched.

Adjustable Dials. Graduated to thousandths of an inch.

- Pump. Placed inside frame. Tank cast in base; capacity 8 1-2 gallons.
- Vise. Flanged. Jaws hardened, 6 1-5" wide, 1 9-16" deep, open 3 5-8".
- Floor Space. At right angles to spindle, 96". Parallel to spindle, 76".
- Weights. Net, about 4400 lbs.; ready for shipment, about 5000 lbs. Dimensions for shipment, 71" x 38" x 72". Space occupied, about 112 cubic feet.
- Equipment. No. 3-F flanged vise, "G" collet, wrenches and everything else shown in cut.

Price. F.o.b. Providence, R. I. \$ Counter-shaft, \$ extra.

Arbors, Collets, Tapers and Attachments, pages 72 to 123.

No. 3

48

34 in. x 12 in. x 20 in.

PLAIN MILLING MACHINE.

Patented Feb. 6. 1900; Jan. 13, 1903; July 11, Dec. 12, 1905.



Capacity:

LONGITUDINAL FEED, 34" TRANSVERSE FEED, 12" VERTICAL FEED, 20"

AUTOMATIC.

No. 3 34 in. x 12 in. x 20 in. PLAIN MILLING MACHINE.

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Frontend threaded, 4" diameter, 3, L.H. Has No. 11 taper hole. Recess in end and cap nut for arbor or collet with clutch collar. Hole through, 3-4" diameter.
- **Drive.** Cone, 4 steps, largest 11 1-2" diameter. 3" belt. Back gears at front. 16 changes of spindle speed, 13 to 439 revolutions per minute. Speeds in geometrical progression.
- Arbor Support. Overhanging arm, solid steel. Both bearings clamped with one lever. Centre of spindle to under side of arm, 6 3-8". End of spindle to centre in arbor support, without arm braces, 29 1-4". Bronze bushing for arbor bearing, hole 2 1-16" diameter. Adjustable centre. Arm braces furnished. End of spindle to arbor bushing, with arm braces, 24 1-4". Face of column to arm braces, 26".
- **Table.** Including oil pans and channels, 57 1-2" x 14 9-16". Working surface, 51" x 14 9-16". 3 T slots, 5-8" wide. Quick automatic travel of 75" per minute in either direction. Elevating screw, telescopic. Knee clamped from front. Provision for driving 20" Circular Milling Attachment.
- Feeds. Positive. All hardened spur gears driven by chain. 20 changes in geometrical progression, from .004" to .200" per revolution of spindle. No loose change gears. Changes made by adjustment of index slide and levers. Feeds started stopped and reversed by lever on front of knee. Feed tripping mechanism, double plunger type. Hand wheels clutched.

Adjustable Dials. Graduated to thousandths of an inch.

- Pump. Placed inside frame. Tank cast in base; capacity 7 1-2 gallons.
- Vise. Flanged. Jaws hardened, 6 1-8" wide, 1 9-16" deep, open 3 5-8".
- Counter-shaft. 2 pairs of tight and loose pulleys, 14" and 18" diameter. 3 1-2" belts. Speeds: 308 and 120 revolutions per minute.
- Floor Space. At right angles to spindle, 97". Parallel to spindle, 73".
- Weights. Net, about 4500 lbs.; ready for shipment, about 5100 lbs. Dimensions for shipment, 69" x 38" x 72". Space occupied, about 109 cubic feet.
- Equipment. No. 3-F flanged vise, "G" collet, wrenches and everything else shown in cut, together with overhead works.

Price. F.o.b. Providence, R. I. \$

Arbors, Collets, Tapers and Attachments, pages 72 to 123.

No. 3B 34 in. x 12 in. x 20 in. PLAIN MILLING MACHINE.

50

Constant Speed Drive.

Patented Feb. 6, 1900; Jan. 6, Jan. 13, 1903; July 11, Dec. 12, 1905; May 28, 1907; July 16, 1912. Others pending.



Capacity:

LONGITUDINAL FEED, 34" TRANSVERSE FEED, 12" VERTICAL FEED, 20"

AUTOMATIC.

No. 3B 34 in. x 12 in. x 20 in. PLAIN MILLING MACHINE.

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end threaded, 4" diameter, 3 L.H. Has No. 11 taper hole. Hole through, 3-4" diameter. Recess in end and cap nut for arbor or collet with clutch collar.
- Drive. 1 friction clutch pulley, 14" diameter. 4" belt. Runson ball bearings at constant speed, 320 revolutions per minute. Can be driven direct from main line. Back geared. Ratio of gearing, 1 to 18.8: 1. 16 changes of speed in geometrical progression, 17 to 390 revolutions per minute. Reverse within machine. Changes made by adjustment of index slide and levers. Locking device for tumbler gear.
- Arbor Support. Overhanging arm, solid steel. Both bearings clamped with one lever. Centre of spindle to under side of arm, 6 3-8". End of spindle to centre in arbor support, without arm braces, 29 1-4". Bronze bushing for arbor bearing, hole 2 1-16" diameter. Adjustable centre. Arm braces furnished. End of spindle to arbor bushing in arm braces, 24 1-4". Face of column to arm braces, 26".
- Table. Including oil pans and channels, 57 1-2" x 14 9-16". Working surface, 51" x 14 9-16". 3 T slots, 5-8" wide. Quick automatic travel of 75" per minute in either direction. Elevating screw, telescopic. Knee clamped from front. Provision for driving 20" Circular Milling Attachment.
- Feeds. Positive. All hardened spur gears driven by chain direct. Safety device in gear train. 20 changes, in geometrical progression, from 3-10" to 15" per minute. Independent of spindle speeds. Range for small mills, .008" to .038" per revolution of spindle; large mills, .017" to .882". No loose change gears. Changes made by adjustment of index slide and levers. Feeds started, stopped and reversed by lever on front of knee. Feed tripping mechanism, double plunger type. Hand wheels clutched.

Adjustable Dials. Graduated to thousandths of an inch.

- Pump. Placed inside frame. Tank cast in base; capacity 8 1-2 gallons.
- Vise. Flanged. Jaws hardened, 6 1-8" wide, 1 9-16" deep, open 3 5-8".
- Floor Space. At right angles to spindle, 97" Parallel to spindle, 78 1-2".
- Weights. Net, about 4450 lbs.; ready for shipment, about 5050 lbs. Dimensions for shipment, 76" x 38" x 72". Space occupied, about 120 cubic feet.

Equipment. No. 3-F flanged vise, "G" collet, wrenches and everything else shown in cut.

Price. F.o.b. Providence, R.I. \$ Counter-shaft, \$ extra.

Arbors, Collets, Tapers and Attachments, pages 72 to 123.



Capacity:

LONGITUDINAL FEED, 34" TRANSVERSE FEED, 12" VERTICAL FEED, 20"

AUTOMATIC.

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No. 3B HEAVY 34 in. x 12 in. x 20 in. PLAIN MILLING MACHINE.

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end threaded, 4" diameter, 3, L.H. Has No. 11 taper hole. Hole through, 3-4" diameter. Recess in end and cap nut for arbor or collet with clutch collar.
- Drive. 1 friction clutch pulley, 16" diameter. 5" belt. Runson ball bearings at constant speed, 320 revolutions per minute. Can be driven direct from main line. Back geared. Ratio of gearing, 1 to 20:1. 16 changes of spindle speed in geometrical progression, 16 to 370 revolutions per minute. Changes made by adjustment of index slide and levers. Locking device for tumbler gear.
- Arbor Support. Overhanging arm, solid steel. Both bearings clamped from one point. Centre of spindle to under side of arm, 71.4". End of spindle to centre in arbor support, without arm braces, 33.1.4". Bronze bushing for arbor bearing, hole 2.5.16" diameter. Adjustable centre. Arm braces furnished. End of spindle to arbor bushing in arm braces, 28". Face of column to arm braces, 29 3-4".
- Table. Including oil pans and channels, 60" x 18". Working surface, 53" x 18". 3 T slots, 3-4" wide. Quick automatic travel of 82" per minute in either direction. Elevating screw, telescopic. Knee clamped from front. Provision for driving 20" and 26" Circular Milling Attachments.
- Feeds. Positive. All hardened spur gears driven by chain direct. Safety device in gear train. 16 changes in geometrical progression, from 5-8" to 20" per minute. Independent of spindle speeds. Range for small mills, .0017" to .054" per revolution of spindle; large mills, .039" to 1.25". No loose change gears. Changes made by adjustment of index slide and levers. Feeds started, stopped and reversed by lever on front of knee. Feed tripping mechanism, double plunger type. Hand wheels clutched.

Adjustable Dials. Graduated to thousandths of an inch.

- Pump. Placed inside frame. Tank cast in base; capacity. 12 gallons.
- Vise. Flanged. Jaws hardened, 7 1-8" wide, 2" deep, open 4 1-2".
- Floor Space. At right angles to spindle, 100". Parallel to spindle, 91".
- Weights. Net, about 6400 lbs.; ready for shipment, about 7100 lbs. Dimensions for shipment, 84" x 44" x 75". Space occupied, about 161 cubic feet.
- Equipment. No. 4-F flanged vise, "G" collet, wrenches and everything else shown in cut.
- Prices. F.o.b. Providence, R. I. \$

Counter-shaft (one pair of tight and loose pulleys, 16" diameter, 5" belt), \$ extra.

Arbors, Collets, Tapers and Attachments, pages 72 to 123.

No. 4B 42 in. x 14 in. x 20 in. PLAIN MILLING MACHINE.

54

Constant Speed Drive.

Patented Feb. 6, 1900; Jan. 6, Jan. 13, 1903; July 11, Dec. 12, 1905; May 28, 1907; July 16, 1912. Others pending.



Capacity:

LONGITUDINAL FEED, 42" TRANSVERSE FEED, 14" VERTICAL FEED, 20"

AUTOMATIC.

No. 4B 42 in. x 14 in. x 20 in.

PLAIN MILLING MACHINE.

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end threaded, 4" diameter, 3, L.H. Has No. 11 taper hole. Hole through, 3-4" diameter. Recess in end and cap nut for arbor or collet with clutch collar.
- Drive. 1 friction clutch pulley, 16" diameter. 5" belt. Runs on ball bearings at constant speed, 320 revolutions per minute. Can be driven direct from main line. Back geared. Ratio of gearing, 1 to 20:1. 16 changes of spindle speed in geometrical progression, 16 to 370 revolutions per minute. Changes made by adjustment of index slide and levers. Locking device for tumbler gear.
- Arbor Support. Overhanging arm, solid steel. Both bearings clamped from one point. Centre of spindle to under side of arm, 7 1-4". End of spindle to centre in arbor support, without arm braces, 35 1-4". Bronze bushing for arbor bearing, hole 2 5-16" diameter. Adjustable centre. Arm braces furnished. End of spindle to arbor bushing in arm braces, 30". Face of column to arm braces, 32".
- Table. Including oil pans and channels, 68" x 18". Working surface, 61" x 18". 3 T slots, 3-4" wide. Quick automatic travel of 82" per minute in either direction. Elevating screw, telescopic. Knee clamped from front. Provision for driving 20" and 26" Circular Milling Attachments.
- Feeds. Positive. All hardened spur gears driven by chain direct. Safety device in gear train. 16 changes in geometrical progression, from 5-8" to 20" per minute. Independent of spindle speeds. Range for small mills, .0017" to .054" per revolution of spindle; large mills, .039" to 1.25". No loose change gears. Changes made by adjustment of index slide and levers. Feeds started, stopped and reversed by lever on front of knee. Feed tripping mechanism, double plunger type. Hand wheels clutched.

Adjustable Dials. Graduated to thousandths of an inch.

- Pump. Placed inside frame. Tank cast in base; capacity 12 gallons.
- Vise. Flanged. Jaws hardened, 7 1-8" wide, 2" deep, open 4 1-2".
- Floor Space. At right angles to spindle, 116". Parallel to spindle, 95".
- Weights. Net, about 6500 lbs.; ready for shipment, about 7450 lbs. Dimensions for shipment, 86" x 51" x 75". Space occupied, about 190 cubic feet.
- Equipment. No. 4-F flanged vise, "G" collet, wrenches and everything else shown in cut.
- Price. F.o.b. Providence, R. I. \$ Counter-shaft (one pair of tight and loose pulleys, 16" diameter, 5" belt), \$ extra.

Arbors, Collets, Tapers and Attachments, pages 72 to 123.

No. 4B HEAVY 42 in. x 14 in. x 20 in. PLAIN MILLING MACHINE.

56

Constant Speed Drive.

Patented Feb. 6, 1900; Jan. 6, Jan. 13, 1903; July 11, Dec. 12, 1905; May 28, 1907; July 16, 1912. Others pending.



Capacity:

LONGITUDINAL FEED, 42" TRANSVERSE FEED, 14" VERTICAL FEED, 20"

No. 4B HEAVY 42 in. x 14 in. x 20 in. PLAIN MILLING MACHINE.

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end threaded, 4 1-2" diameter, 2 3-4, L.H. Has No. 12 taper hole. Hole through, 3-4" diameter. Recess in end and cap nut for arbor or collet with clutch collar.
- Drive. 1 friction clutch pulley, 18" diameter. 6" belt. Runs on ball bearings at constant speed, 320 revolutions per minute. Can be driven direct from main line. Back geared. Ratio of gearing, 1 to 21.3:1. 16 changes of spindle speed in geometrical progression, 15 to 350 revolutions per minute. Changes made by adjustment of index slide and levers. Locking device for tumbler gear.
- Arbor Support. Overhanging arm, solid steel. Both bearings clamped from one point. Centre of spindle to under side of arm, 8 3-8". End of spindle to centre in arbor support, without arm brace, 35". Bronze bushing for arbor bearing, hole 2 9-16" diameter. Adjustable centre. Arm brace furnished. End of spindle to arbor bushing in arm brace, 29 3-4". Face of column to arm brace, 31 1-2".
- Table. Including oil pans and channels, 70" x 20 1-2". Working surface, 62 1-2" x 20 1-2". 3 T slots, 3-4" wide. Quick automatic travel of 83" per minute in either direction. Elevating screw, telescopic. Knee clamped from front. Provision for driving 20" and 26" Circular Milling Attachments.
- Feeds. Positive. All hardened spur gears driven by chain direct. Safety device in gear train. 16 changes in geometrical progression, from 5-8" to 20" per minute. Independent of spindle speeds. Range for small mills, .0018" to .057" per revolution of spindle; large mills, .041" to 1.33". No loose change gears. Changes made by adjustment of index slide and levers. Feeds started, stopped and reversed by lever on front of knee. Feed tripping mechanism, double plunger type. Hand wheels clutched.

Adjustable Dials. Graduated to thousandths of an inch.

- Pump. Placed inside frame. Tank cast in base; capacity 14 gallons.
- Vise. Flanged. Jaws hardened, 8 5-8" wide, 2 1-2" deep, open 7".
- Floor Space. Right angles to spindle, 118". Parallel to spindle, 103".
- Weights. Net, about 8650 lbs.; ready for shipment, about 9600 lbs. Dimensions for shipment, 92" x 51" x 78". Space occupied, about 212 cubic feet.

Equipment. No. 5-F flanged vise, "T" collet, wrenches and everything else shown in cut.

Price. F.o.b. Providence, R. I. \$

Counter-shaft (1 pair of tight and loose pulleys, 18" diameter, 6" belt), \$ extra.

Arbors, Collets, Tapers and Attachments, pages 72 to 123.



Capacity:

LONGITUDINAL FEED, 50" TRANSVERSE FEED, 14" VERTICAL FEED, 21" No. 5B HEAVY 50 in. x 14 in. x 21 in. PLAIN MILLING MACHINE.

59

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end threaded, 4 1-2" diameter, 2 3-4, L.H. Has No. 12 taper hole. Hole through, 3-4" diameter. Recess in end and cap nut for arbor or collet with clutch collar.
- Drive. 1 friction clutch pulley, 20" diameter. 7" belt. Runs on ball bearings at constant speed, 320 revolutions per minute. Can be driven direct from main line. Back geared. Ratio of gearing, 1 to 22.8: 1. 16 changes of spindle speed in geometrical progression, 14 to 330 revolutions per minute, obtained by gearing. Changes made by adjustment of index slide and levers. Locking device for tumbler gear.
- Arbor Support. Overhanging arm, solid steel. Centre of spindle to under side of arm, 91-2". End of spindle to centre in arbor support, without arm brace, 40". Bronze bushing for arbor bearing, hole 2 9-16" diameter. Adjustable centre. Arm brace furnished. End of spindle to arbor bushing in arm brace, 34 1-2". Face of column to arm brace, 36 1-4".
- Table. Including oil pans and channels, 81" x 22 1-2". Working surface, 73" x 22 1-2". 4 T slots, 3-4" wide. Quick automatic travel ot 79" per minute in either direction. Elevating screw, telescopic. Knee clamped from front. Provision for driving 20" and 26" Circular Milling Attachments.
- Feeds. Positive. All hardened spur gears driven by chain direct. Safety device in gear train. 16 changes in geometrical progression, from 5-8" to 20" per minute. Independent of spindle speeds. Range for small mills, .0019" to .060" per revolution of spindle; large mills, .045" to 1.43". No loose change gears. Changes made by adjustment of index slide and levers. Feeds started, stopped and reversed by lever on front of knee. Feed tripping mechanism, double plunger type. Hand wheels clutched.

Adjustable Dials. Graduated to thousandths of an inch.

- Pump. Placed inside frame. Tank cast in base; capacity 18 gallons.
- Vise. Flanged. Jaws hardened, 8 5-8" wide, 2 1-2" deep, open 7".
- Floor Space. At right angles to spindle, 138". Parallel to spindle, 110".
- Weights. Net, about 11,350 lbs.; ready for shipment, about 12,600 lbs. Dimensions for shipment, 100" x 60" x 82". Space occupied, about 285 cubic feet.
- Equipment. No. 5-F flanged vise, "T" collet, wrenches and everything else shown in cut.
- Price. F.o.b. Providence, R. I. \$ Counter-shaft, (1 pair of tight and loose pulleys, 20" diameter, 7" belt), \$ extra.

Arbors, Collets, Tapers and Attachments, pages 72 to 123.

No. 12

No. 58 HEAVY 50 mar 14 m.

60

26 in. x 5-8 in. x 9 in.

PLAIN MILLING MACHINE.



Capacity:

LONGITUDINAL FEED, 26", AUTOMATIC. TRANSVERSE ADJUSTMENT OF SPINDLE, 5-8". VERTICAL ADJUSTMENT OF SPINDLE, 9".

No. 12 26 in. x 5-8 in. x 9 in. PLAIN MILLING MACHINE.

- **Spindle.** Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Driven from cone by gear and pinion. Vertical adjustment by means of nuts on vertical screw, 9". Transverse adjustment, 5-8". Front end has No. 10 taper hole.
- Drive. Cone, 3 steps, largest 12 11-16" diameter. 2 1-2" belt. 6 changes of spindle speed, 50 to 150 revolutions per minute.
- Arbor Support. Overhanging arm, solid steel. Centre of spindle to under side of arm, 3 11-16". End of spindle to centre in arbor support, without arm brace, 13 1-4". Bronze bushing for arbor bearing, hole 1 13-16" diameter. Adjustable centre. Arm brace furnished. End of spindle to arbor bushing, with arm brace, 8 1-4". Face of spindle head to arm brace, 13 1-2".
- Table. Including oil pans and channels, 41"x 11". Working surface, 29" x 6". 1 T slot, 5-8" wide. Greatest distance from centre of spindle to top of table, 9"; least, 2 1-2". Quick return operated by hand wheel on front of saddle.
- Feed. Positive. All spur gears driven by chain. 6 changes by means of change gears, from .009" to .076" per revolution of spindle. Longitudinal, automatic, 26" in either direction.
- Base. Amply heavy to insure rigidity. Rests on 4 legs; affords ample space for convenient placing of work boxes, etc. Top has oil rim.
- Pump. Placed on side of bed. Tank cast in bed; capacity 4 1-2 gallons.
- Vise. Flanged. Jaws hardened, 6 1-8" wide, 1 9-16" deep, open 3 5-8".
- Counter-shaft. 2 friction pulleys, 12" diameter. 3 1-2" belts. Speeds, 310 and 386 revolutions per minute.
- Floor Space. At right angles to spindle, 67". Parallel to spindle, 46".
- Weights. Net, about 1950 lbs.; ready for shipment, about 2300 lbs. Dimensions for shipment, 49"x 45"x 59". Space occupied, about 75 cubic feet.
- Equipment. No. 3-F flanged vise, wrenches and everything else shown in cut, together with overhead works.

Price. F.o.b. Providence, R. I. \$

Arbors, Collets and Tapers, pages 78 to 88; Index Centres, pages 111 to 120.

No. 13B

62

34 in. x 6 in. x 12 in.

PLAIN MILLING MACHINE.



Capacity:

LONGITUDINAL FEED, 34", AUTOMATIC. TRANSVERSE ADJUSTMENT, 6". VERTICAL ADJUSTMENT OF SPINDLE, 12".

No. 13B 34 in. x 6 in. x 12 in. PLAIN MILLING MACHINE.

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes provided with means of compensation for wear. Front end threaded, 4" diameter, 3, L.H. No. 11 taper hole. Hole through, 11-16" diameter. Recess in end for arbor or collet with clutch collar; holding nut furnished. Vertical adjustment, 12".
- Drive. 1 friction clutch pulley, 14" diameter. 4" belt. Runs at constant speed, 300 revolutions per minute. Can be driven direct from main line. Maximum ratio of gearing, 13 1-2 to 1. 12 changes of spindle speed, 22 to 180 revolutions per minute; obtained by change gears. Speeds in practically geometrical progression.
- Arbor Support. Overhanging arm, solid steel. Centre of spindle to under side of arm, 5 1-2". End of spindle to centre in arbor support, without arm brace, 27 1-4". Bronze bushing for outer bearing of arbor, hole 2 1-16" diameter. Adjustable centre. Arm brace furnished. End of spindle to arbor bushing in arm brace, 20". Face of spindle head to arm brace, 24".
- **Table.** Including oil pans and channels, 74" x 17 1-4". Working surface, 40" x 12 1-2". 3 T slots, 5-8" wide. Quick return operated by hand wheel on front of bed. Same wheel controls both longitudinal feed and transverse movement.
- Feed. Positive. All spur gears. 8 changes in geometrical progression. from 3-4" to 9" per minute. Independent of spindle speeds. Range for small mills, .004" to .050" per revolution of spindle; for large mills, .034" to .410". Changes made by change gears.

Adjustable Dials. Graduated dials reading to thousandths of an inch for transverse and vertical adjustments.

Base. Amply heavy to insure rigidity. Top has oil rim.

- Pump. Placed on side of bed. Tank cast in bed; capacity 42 gallons.
- Vise. Flanged. Jaws hardened, 6 1-8" wide, 1 9-16" deep, open 3 5-8".
- Floor Space. Right angles to spindle, 108". Parallel to spindle, 69".
- Weights. Net, about 4500 lbs.; ready for shipment, about 5050 lbs. Dimensions for shipment, 66" x 49" x 75". Space occupied, about 140 cubic feet.
- Equipment. No. 3-F flanged vise, wrenches and everything else shown in cut.
- Price. F.o.b. Providence, R. I. \$
- Counter-shaft (1 friction pulley, 14" diameter, 4" belt), \$ extra.
- Arbors, Collets and Tapers, pages 78 to 88; Index Centres, pages 111 to 120.

No. 1 22 in. x 12 in. x 18 in. VERTICAL SPINDLE MILLING MACHINE.

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Patented Feb. 6, 1900; Jan. 13, 1903; July 11, 1905; Jan. 9, 1906.



LONGITUDINAL FEED, 22" AUTOMATIC. TRANSVERSE FEED, 12" VERTICAL FEED: Knee, 14"; Spindle Head, 4".

No. 1 22 in. x 12 in. x 18 in. VERTICAL SPINDLE MILLING MACHINE.

Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes; lower box provided with means of compensation for wear. Lower end has No. 10 taper hole. Hole through, 5-8" diameter. Centre of spindle to throat of column, 14". Drawing-in bolt furnished. Spindle pulley on separate sleeve.

- Drive. Cone, 4 steps, largest 14" diameter. 3" belt. 8 changes of spindle speed direct, 80 of 1000 revolutions per minute; 4 reverse, 97 to 848 revolutions per minute.
- Spindle Head. Fine hand feed. Quick return. Micrometer stop for controlling depth of cut. Counter-balanced.
- Table. Including oil pans and channels, 42 3-4" x 11 1 2". Working surface, 37" x 11 1-2". 3 T slots, 5-8" wide. Quick return operated by internal gear and pinion. Elevating screw, telescopic. Knee clamped from front. Provision for driving 18" Circular Milling Attachment.

Vertical Adjustment. Greatest distance, end of spindle to top of table, 18". Adjustment of spindle head, 4"; of knee, 14".

Feeds. Positive. All spur gears driven by chain. 20 changes in geometrical progression, from .002" to .100" per revolution of spindle. No loose change gears. Changes made by adjustment of index slide and levers. Feed tripping mechanism, double plunger type. Hand wheels clutched.

Adjustable Dials. Graduated to thousandths of an inch.

Tank. Cast in base, capacity 7 gallons. Provision for pump on side of frame.

Vise. Swivels. Base graduated. Jaws hardened, 5 1-8" wide, 1 1-4" deep, open 2 3-4".

Counter-shaft. 3 friction pulleys, 12" diameter. 3 1-2" belts. Speeds: direct, 236 and 338 revolutions per minute; reverse, 287.

Floor Space. Right angles to table, 75". Parallel to table, 78".

Weights. Net, about 3025 lbs.; ready for shipment, about 3725 lbs. Dimensions for shipment, 78" x 40" x 80". Space occupied, about 141 cubic feet.

Equipment. No. 2-S swivel vise, "BB" collet, oil can and stand, wrenches, table stops and everything else shown in cut, together with overhead works.

Price.F.o.b. Providence, R. I. \$Pump, \$extra.Circular Milling Attachment, \$extra.

¹ Circular Milling Attachments, pages 106 to 109.

High Speed Milling Attachment, and Horizontal Milling Attachment, page 110.



Constant Speed Drive. Patented Feb. 6, 1900; Jan. 6, Jan. 13, 1903; July 11, 1905; May 28, 1907. Others pending.



Capacity:

LONGITUDINAL FEED, 28" TRANSVERSE FEED, 14" VERTICAL FEED: Knee, 14"; Spindle Head, 6"

AUTOMATIC.

No. 2 28 in. x 14 in. x 20 in. VERTICAL SPINDLE MILLING MACHINE.

67

Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes; lower box provided with means of compensation for wear. Lower end threaded, 4" diameter, 3, L.H. Has No. 11 taper hole. Hole through, 13-16" diameter. Distance, centre of spindle to throat of column, 16". Recess in end for arbor or collet with clutch collar. Arbors and collets held in place by drawing-in bolt.

- Drive. 1 friction clutch pulley, 14" diameter. 4" belt. Runs on ball bearings at constant speed, 320 revolutions per minute. Back geared. Ratio of gearing, 1 to 18.8 to 1. 16 changes of speed in geometrical progression, 17 to 390 revolutions per minute in either direction, obtained by gearing. Reverse within machine. Changes made by simple adjustment of index slide and levers. Locking device for tumbler gear.
- Spindle Head. Automatic feed for drilling. Fine hand feed. Quick return. Micrometer stop for controlling depth of cut. Counter-balanced.
- **Table.** Including oil pans and channels, 51 1-2" x 14 9-16". Working surface, 45" x 14 9-16". 3 T slots, 5-8" wide. Quick automatic travel of 75" per minute in direction. Elevating screw, telescopic. Knee clamped from front. Provision for driving 20" Circular Milling Attachment.
- Vertical Adjustment. Greatest distance, end of spindle to top of table, 20". Adjustment of spindle, 6"; of knee, 14".
- Feeds. Positive. All hardened spur gears driven by chain direct. Safety device in gear train. 20 changes in geometrical progression from 3-10" to 15" per minute. Independent of spindle speeds. Range for small mills, .0008" to .038"; large mills, .018" to .882" per revolution of spindle. No loose change gears. Changes made by simple adjustment of index slide and levers. Feeds started, stopped and reversed by lever on front of knee. Feed tripping mechanism, double plunger type. Hand wheels clutched.

Adjustable Dials. Graduated to thousandths of an inch.

- Tank. Cast in base; capacity 7 1-2 gallons. Provision for pump inside frame.
- Vise. Flanged. Jaws hardened, 6 1-8" wide, 1 9-16" deep, open, 3 5-8".

Floor Space. Right angles to table, 80". Parallel to table, 85".

Weights. Net, about 4550 lbs. Ready for shipment, about 5225 lbs. Dimensions for shipment, 77" x 40" x 83". Space occupied, about 148 cubic feet.

Equipment. No. 3-F flanged vise, "H" collet, oil can, wrenches and everything else shown in cut.

Price. F.o.b. Providence, R. I. \$ Pump, \$ extra. Circular Milling Attachment, \$ extra. Counter-shaft, \$ extra.

Circular Milling Attachment, pages 106 and 107.

No. 3 34 in. x 16 in. x 22 in. VERTICAL SPINDLE MILLING MACHINE.

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Constant Speed Drive. Patented Feb. 6, 1900; Jan. 6, Jan. 13, 1903; July 11, 1905; May 28, 1907. Others pending.

Capacity:

LONGITUDINAL FEED, 34" TRANSVERSE FEED, 16" VERTICAL FEED: Knee, 14"; Spindle Head, 8"

AUTOMATIC.

No. 3 34 in. x 16 in. x 22 in. VERTICAL SPINDLE MILLING MACHINE.

- Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes; lower box provided with means of compensation for wear. Lower end threaded, 4" diameter, 3, L.H. Has No. 11 taper hole. Hole through, 13-16" diameter. Recess in end for arbor or collet with clutch collar. Drawing-in bolt furnished. Distance from centre of spindle to throat of column, 18".
- Drive. 1 friction clutch pulley, 16" diameter. 5" belt. Runs on ball bearings at constant speed, 320 revolutions per minute. Back geared. Ratio of gearing, 1 to 20:1. 16 changes of speed in geometrical progression, 16 to 370 revolutions per minute in either direction, obtained by gearing. Reverse within machine. Changes made by adjustment of index slide and levers. Locking device for tumbler gear.
- Spindle Head. Automatic feed for drilling. Fine hand feed. Quick return. Micrometer stop for controlling depth of cut. Counter-balanced.
- Table. Including oil pans and channels, 60" x 18". Working surface, 53" x 18". 3 T slots, 3-4" wide. Quick automatic travel of 78" per minute in either direction. Elevating screw, telescopic. Knee clamped from front. Provision for driving 20" and 26" Circular Milling Attachments.
- Vertical Adjustment. Greatest distance, end of spindle to top of table, 22". Adjustment of spindle head, 8"; of knee, 14".
- Feeds. Positive. All hardened spur gears driven by chain direct. Safety device in gear train. 16 changes in geometrical progression, from 5-8" to 20" per minute. Independent of spindle speeds. Range for small mills, .0017" to .054" per revolution of spindle; large mills, .039" to 1.25". No loose change gears. Changes made by adjustment of index slide and levers. Feeds started, stopped and reversed by lever on front of knee. Feed tripping mechanism, double plunger type. Hand wheels clutched.

Adjustable Dials. Graduated to thousandths of an inch.

- Tank. Cast in base; capacity 9 gallons. Provision for pump inside frame.
- Vise. Flanged. Jaws hardened, 7 1-8" wide, 2" deep, open 4 1-2".
- Floor Space. Right angles to table, 92 1-2". Parallel to table, 100".
- Weights. Net, about 6750 lbs.; ready for shipment, about 7650 lbs. Dimensions for shipment, 84" x 49" x 87". Space occupied, about 207 cubic feet.
- Equipment. No. 4-F flanged vise, "H" collet, oil can, wrenches and everything else shown in cut.
- Price. F.o.b. Providence, R. I. \$ Pump, \$ extra. Circular Milling Attachment, \$ extra. Counter-shaft, \$ extra.

Circular Milling Attachment, pages 106 and 107.



Patented Feb. 6, 1900; July 11, 1905.



Capacity:

LONGITUDINAL FEED, 52" AUTOMATIC. TRANSVERSE FEED, 12" AUTOMATIC. VERTICAL FEED OF SPINDLE, 3". VERTICAL ADJUSTMENT OF SPINDLE HEAD, 21".

No. 5 52 in. x 12 in. x 24 in. VERTICAL SPINDLE MILLING MACHINE.

Spindle. Of crucible steel. Bearings ground. Phosphor bronze boxes; lower box provided with means of compensation for wear. Driven from vertical driving shaft by chain and sprocket wheels. Back geared. Lower end threaded, 4" diameter, 3, L.H. Has No. 11 taper hole. Hole through, 13-16" diameter. Recess in end for arbor or collet with clutch collar. Centre of spindle to column, 13 1-2". Drawing-in bolt furnished.

- Drive. Cone, 3 steps, largest, 16" diameter. 4 1-2" belt. With 2 speeds of counter-shaft, 12 changes of spindle speed, in geometrical progression, 14 to 370 revolutions per minute.
- Table. Including oil pans and channels, 64"x 16". Working surface, 52" x 16". 3 T slots, 3-4" wide. Feed screw not splined.
- Vertical Adjustment. Greatest distance, end of spindle to top of table, 24"; least, 3-4". Adjustment of spindle head, 21". Micrometer adjustment of spindle, 3".
- Feeds. Positive. Driven direct from cone shaft by spur gears. Changes for longitudinal and transverse: with back gears in, 20, from .012" to .600" per revolution of spindle; with back gears out, 20, from .002" to .100". Feeds in geometrical progression. Changes made by adjustment of index slide and levers.

Adjustable Dials. Graduated to thousandths of an inch.

- Counter-shaft. 2 pairs of tight and loose pulleys, 14" and 18" diameter. 4 1-2" belts. Speeds: 441 and 326 revolutions per minute.
- Floor Space. Right angles to table, 85". Parallel to table, 119".

Weights. Net, about 6745 lbs.; ready for shipment, about 7750 lbs. Dimensions for shipment, 88"x 59"x 73". Space occupied, about 220 cubic feet.

Equipment. "H" collet, oil can, wrenches and everything else shown in cut, together with overhead works.

Price.	F.o.b. Providence, R. I. \$	Pump, \$	extra.
Circ	ular Milling Attachment, \$	extra.	
	The second		

Circular Milling Attachments, pages 106 to 109.

TOOLS FOR USE ON MILLING MACHINES.

The Tools in the following lists, we have found by experience to be among those first needed in using these machines. They are shipped with each machine and, if not wanted, are to be carefully packed and returned by express at our expense.

All Cutting Tools listed in the Sets of Tools are of High Speed Steel.

For Nos. 1, 1A, 1D, 1AD, 2 and 2A Universal Milling Machines.

No. 120	Screw Arbor, 3-8" dia., 20 thds., L.H. No. 7 taner
No. 41	Milling Arbor, 1" dia., 12" long, No. 10 taper shank
	1 5-16" Milling Arbor Wrench.
	"A" Collet and Key, Nos. 7 and 4 taper
No. E106	Spiral End Mill, 7-16" dia., L.H., No. 4 taper
No. E113	Spiral End Mill, 5-8" dia., L.H., No. 7 taper
No. E120	Spiral End Mill, 7-8" dia., L.H., No. 7 taper
No. E728	Spiral End Mill (Coarse Tooth), 1 1-8" dia., L.H., No. 7 taper.
No. M35	Plain Milling Cutter, 2 1-2" dia 3" face 1" holo
No. M301	Coarse Tooth Milling Cutter, 2 1-2" dia., 3" face, 1" hole.
To. S36	Two Side Milling Cutters, 4" dia., 5-8" face 1" holo
Io. G60	Metal Slitting Saw, 3" dia., 1-8" thick, 1" hole.
lo. J25	60° Angular Cutter, R.H., 1 1-4" dia., 7-16" thick, 3-8"-20 L.H. hole.
lo. J25	60° Angular Cutter, L.H., 1 1-4" dia., 7-16" thick, 3-8"-20 L.H. hole.
o. J151	53° and 12° Angular Cutter for Spiral Mills, L.H., 2 3-4" dia., 1-2" thick, 1" hole.
leight, re	eady for shipment, about 35 lbs. Price. \$

List continued on next page.

MILLING MACHINE TOOLS. (CONTINUED)

For Nos. 3 and 3A Universal Milling Machines.

No. 122	Screw Arbor, 1-2" dia., 16 thds., L.H., No. 9 taper.
No. 158	Screw Arbor, 1 1-2" dia., 8 thds., L.H., No. 11 taper.
	2 1-4" Screw Arbor Wrench.
No. 22A	Milling Arbor, 1 1-4" dia., 24" long, No. 11 taper shank. 1 5-16" Milling Arbor Wrench.
No. E117	Spiral End Mill, 3-4" dia., L.H., No. 9 taper.
No. E125	Spiral End Mill, 1" dia., L.H., No. 9 taper.
No. E733	Spiral End Mill (Coarse Tooth), 1 1-4" dia., L.H., No. 9 taper.
No. F203	Coarse Tooth Spiral Shell End Mill, 4" dia., 2" face, 1 1-2"-8 L.H. hole.
No. M80	Plain Milling Cutter, 3" dia., 4" face, 1 1-4" hole.
No. M310	Coarse Tooth Mil'g Cut'r, 3" dia., 4" face, 11-4" hole.
No. S42	Two Side Mil'g Cut'rs, 5" dia., 3-4" face, 11-4" hole.
No. G72	Metal Slitting Saw, 5" dia., 1-8" thick, 1 1-4" hole.
No. J26	60° Angular Cutter, R.H., 1 5-8" dia., 9-16" thick, 1-2"-16 L.H. hole.
No. J26	60° Angular Cutter, L.H., 1 5-8" dia., 9-16" thick, 1-2"-16 L.H. hole.
No. J152	53° and 12° Angular Cutter for Spiral Mills, L.H., 3" dia., 1-2" thick, 1 1-4" hole.
Weight re	adv for shinmont about 100 lbs Price S

For Nos. 3A Heavy & 4A Universal Milling Mchs.

No. 122	Screw Arbor, 1-2" dia., 16 thds., L.H., No. 9 taper.
No. 158	Screw Arbor, 1 1-2" dia., 8 thds., L.H., No. 11 taper. 2 1-4" Screw Arbor Wrench.
No. 67A	Milling Arbor, 1 1-2" dia., 26 3-4" long, No. 11 taper shank. 1 5-16" Milling Arbor Wrench.
No. E117	Spiral End Mill, 3-4" dia., L.H., No. 9 taper.
No. E125	Spiral End Mill, 1" dia., L.H., No. 9 taper.
No. E733	Spiral End Mill (Coarse Tooth), 1 1-4" dia., L.H., No. 9 taper.
No. F203	Coarse Tooth Spiral Shell End Mill, 4" dia., 2" face, 1 1.2"-8 L.H. hole.
No. M102A	Plain Milling Cutter, 3 1-2" dia., 4" face, 1 1-2" hole.
No. M318	Coarse Tooth Milling Cutter, 3 1-2" dia., 4" face, 1 1-2" hole.
No. S47	Two Side Mil'g Cut'rs, 6" dia., 15-16" face, 11-2" hole.
No. G73	Metal Slitting Saw, 5" dia., 1-8" thick, 1 1-2" hole.
No. J26	60° Angular Cutter, R.H., 1 5-8" dia., 9-16" thick, 1-2"-16 L.H. hole.
No. J26	60° Angular Cutter, L.H., 1 5-8" dia., 9-16" thick, 1-2"-16 L.H. hole.
No. J153	53° and 12° Cutter for Spiral Mills, L.H., 31-4" dia., 1-2" thick, 11-2" hole.
Weight, re	ady for shipment, about 110 lbs. Price, \$

List continued on next page.

MILLING MACHINE TOOLS.

(CONTINUED)

For No. 4A Heavy Universal Milling Machine.

- No. 122 Screw Arbor, 1-2" dia., 16 thds., L.H., No. 9 taper. No. 166 Screw Arbor, 1 1-2" dia., 8 thds., L.H., No. 12 taper. 2 1-4" Screw Arbor Wrench.
- Milling Arbor, 1 1-2" dia., 29" long, No. 12 taper No. 71A shank, 1 5-16" Milling Arbor Wrench.
- No. E117 Spiral End Mill, 3-4" dia., L.H., No. 9 taper.
- Spiral End Mill, 1" dia., L.H., No. 9 taper. No. E125
- Spiral End Mill (Coarse Tooth), 1 1-4" dia., L.H., No. E733 No. 9 taper.
- Coarse Tooth Spiral Shell End Mill, 4" dia., 2" face, No. F203 1 1-2"-8 L.H. hole.
- No. M102A Plain Milling Cutter, 3 1-2" dia., 4" face, 11-2" hole.
- No. M318 Coarse Tooth Milling Cutter, 3 1-2" dia., 4" face, 1 1-2" hole.
- No. S47 Two Side Milling Cutters, 6" dia., 15-16" face, 1 1-2" hole.
- No. G73 Metal Slitting Saw, 5" dia., 1-8" thick, 1 1-2" hole.
- No. J26 60° Angular Cutter, R.H., 1 5-S" dia., 9-16" thick, 1-2"-16 L.H. hole.
- 60° Angular Cutter, L.H., 1 5-8" dia., 9-16" thick, No. J26 1-2"-16 L.H. hole.
- 53° and 12° Cutter for Spiral Mills, L.H., 31-4" dia., No. J153 1-2" thick, 1 1-2" hole.

Weight, ready for shipment, about 115 lbs. Price, \$

For Nos. 00 and 0 Plain Milling Machines.

No. 08	Milling Arbor, 7-8" dia., 5 1-4" long, No. 9 taper
Sat In San As	shank. 1 3-16" Milling Arbor Wrench.
No. E107	Spiral End Mill, 7-16" dia., L.H., No. 5 taner

- Spiral End Mill, 5-8" dia., L.H., No. 5 taper. No. E112
- Spiral End Mill, 7-8" dia., L.H., No. 9 taper. No. E121
- Spiral End Mill (Coarse Tooth), 1 1-8" dia., L.H., No. E729 No. 9 taper.
- Plain Milling Cutter, 2 1-4" dia., 1-2" face, 7-8" hole. No. M10
- Plain Milling Cutter, 2 1-4" dia., 1" face, 7-8" hole. No. M11
- Plain Milling Cutter, 21-4" dia., 13-4" face, 7-8" hole. No. M12
- No. S25 Two Side Milling Cutters, 2 3-4" dia., 1-2" face, 7-8" hole.

Metal Slitting Saw, 2 1-2" dia., 3-32" thick, 7-8" hole. No. G53

Weight, ready for shipment, about 20 lbs. Price, \$

List continued on next page.

MILLING MACHINE TOOLS.

(CONTINUED)

For Nos. 1, 1B, 1D, 1BD, 2 and 2B Plain Milling Machines.

No. 120	Screw Arbor, 3-8" dia., 20 thds., L.H., No. 7 taper.
No. 41	Milling Arbor, 1" dia., 12" long, No. 10 taper shank.
	1 5-16" Milling Arbor Wrench.
	"A" Collet and Key, Nos. 7 and 4 tapers.
No. E106	Spiral End Mill, 7-16" dia., L.H., No. 4 taper.
No. E113	Spiral End Mill, 5-8" dia., L.H., No. 7 taper.
No. E120	Spiral End Mill, 7-8" dia., L.H., No. 7 taper.
No. E728	Spiral End Mill (Coarse Tooth), 1 1-8" dia., L.H.,
	No. 7 taper.
No. M35	Plain Milling Cutter, 2 1-2" dia., 3" face, 1" hole.
No. M301	Coarse Tooth Milling Cutter, 2 1-2" dia., 3" face,
	1" hole.
No. S36	Two Side Milling Cutters, 4" dia., 5-8" face, 1" hole.
No. G60	Metal Slitting Saw, 3" dia., 1-8" thick, 1" hole.
No. J25	60° Angular Cutter, R.H., 1 1-4" dia., 7-16" thick,
	3-8"-20 L.H. hole.
No. J25	60° Angular Cutter, L.H., 1 1-4" dia., 7-16" thick,
	3-8"-20 L.H. hole.
Weight, re	eady for shipment, about 35 lbs. Price, \$

For Nos. 2BH, 3 and 3B Plain Milling Machines.

No. 158	Screw Arbor, 1 1-2" dia., 8 thds., L.H., No. 11 taper.
	2 1-4" Screw Arbor Wrench.
No. 22A	Milling Arbor, 1 1-4" dia., 24" long, No. 11 taper shank. 1 5-16" Milling Arbor Wrench.
No. E117	Spiral End Mill, 3-4" dia., L.H., No. 9 taper.
No. E125	Spiral End Mill, 1" dia., L.H., No. 9 taper.
No. E733	Spiral End Mill (Coarse Tooth), 1 1-4" dia., L.H.,
	No. 9 taper.
No. F203	Coarse Tooth Spiral Shell End Mill, 4" dia., 2" face, 1 1-2"-8 L.H. hole.
No. M80	Plain Milling Cutter, 3" dia., 4" face, 1 1-4" hole.
No. M310	Coarse Tooth Mil'g Cut'r, 3" dia., 4" face, 11-4" hole.
No. 842	Two Side Mil'g Cut'rs, 5" dia., 3-4" face, 11-4" hole.
No. G72	Metal Slitting Saw, 5" dia., 1-8" thick, 1 1-4" hole.
Weight, r	eady for shipment, about 80 lbs. Price, \$

- No. 67A Milling Arbor, 1 1-2" dia., 26 3-4" long, No. 11 taper shank. 1 5-16" Milling Arbor Wrench. Spiral End Mill, 3-4" dia., L.H., No. 9 taper. Spiral End Mill, 1" dia., L.H., No. 9 taper.
- No. E117
- No. E125 Spiral End Mill (Coarse Tooth), 1 1-4" dia., L.H.,
- No. E733 No. 9 taper.

No. M102A Plain Milling Cutter, 3 1-2" dia., 4" face, 1 1-2" hole.

List continued on next page.

MILLING MACHINE TOOLS.

(CONTINUED)

For Nos. 3B Heavy & 4B Plain Milling Mchs. (Cont.)

No. M318	Coarse Tooth Milling Cutter, 3 1-2" dia., 4" face, 1 1-2" hole.
No. 847	Two Side Mil'g Cut'rs, 6" dia., 15-16" face, 1 1-2" hole,
No. G73	Metal Slitting Saw, 5" dia., 1-8" thick, 1 1-2" hole.
No. 55	Inserted Tooth Face Mil'g Cut'r, 9" dia., 3 3-4" hole.
No. 9	Inserted Tooth Face Milling Cutter Sleeve, hole 4" dia., 3 thds., L.H.
No. 5	Inserted Tooth Face Milling Cutter Clamping Plate.
No. 5	Inserted Tooth Face Milling Cutter Bolt and Nut.
Weight, r	eady for shipment, about 90 lbs. Price, \$
For 1	No. 4B Heavy Plain Milling Machine.
No. 71½A	Milling Arbor, 1 3-4" dia., 29" long, No. 12 taper shank.
No. E117	Spiral End Mill, 3-4" dia., L.H., No. 9 taper.

- No. E125 Spiral End Mill, 1" dia., L.H., No. 9 taper.
- Spiral End Mill (Coarse Tooth), 1 1-4" dia., L.H., No. E733 No. 9 taper.

- No. M133A Plain Milling Cutter, 4" dia., 5" face, 1 3-4" hole. No. M334A Coarse Tooth Mil'g Cut'r, 4" dia., 5" face, 1 3-4" hole. No. S101A Two Inserted Tooth Side Milling Cutters, 7" dia., 2" face, 1 3-4" hole.
- No. G79A Metal Slitting Saw, 6" dia., 3-16" thick, 1 3-4" hole. No. 55 Inserted Tooth Face Mil'g Cut'r, 9" dia., 3 3-4" face. No. 10 Inserted Tooth Face Milling Cutter Sleeve, hole
- 4 1-2" dia., 2 3-4 thds., L.H. Inserted Tooth Face MillingCutter Clamping Plate.
- No. 5
- Inserted Tooth Face Milling Cutter Bolt and Nut. No. 7

Weight, ready for shipment, about 100 lbs. Price, \$

For No. 5B Heavy Plain Milling Machine.

No. 79A	Milling Arbor, 2" dia., 35" long, No. 12 taper shank.
	1 5-8" Milling Arbor Wrench.
BT. THITH	Crinel End Mill 24" die I H No Otener

- Spiral End Mill, 3-4" dia., L.H., No. 9 taper. No. E117
- No. E125
- Spiral End Mill (Coarse Tooth), 1 1-4" dia., L.H., No. E733 No. 9 taper.
- No. M163
- No. M345
- Plain Milling Cutter, 4 1-2" dia., 6" face, 2" hole. Coarse Tooth Mil'g Cut'r, 4 1-2" dia., 6" face, 2" hole. Two Inserted Tooth Side Milling Cutters, 8" dia., No. S102A 2" face, 2" hole.
- No. GS3C
- Metal Slitting Saw, 7" dia., 3-16" face, 2" hole. Inserted Tooth Face Mil'g Cut'r, 10" dia., 3 3-4" face. Inserted Tooth Face Milling Cutter Sleeve, hole No. 58 No. 10
- 4 1-2" dia., 2 3-4 thds., L.H. Inserted Tooth Face Milling Cutter Clamping Plate.
- No. 5
- Inserted Tooth Face Milling Cutter Bolt and Nut. No. 8

Weight, ready for shipment, about 115 lbs. Price, \$

MILLING MACHINE TOOLS. (CONTINUED)

For No. 1 Vertical Spindle Milling Machine.

No. 98	Arbor for Shell End Mill, 1" dia., No. 10 taper.
No. 120	Screw Arbor, 3-8" dia., 20 thds., L.H., No. 7 taper.
	"A" Collet and Key, Nos. 7 and 4 tapers.
No. E700	Spiral End Mill (Coarse Tooth), 1-4" dia., L.H.,
	No. 4 taper.
No. E704	Spiral End Mill (Coarse Tooth), 3-8" dia., L.H.,
No ETOO	Spiral End Mill (Coargo Tooth) 112" dig L.H.
NO. E109	No 7 taner
No. E716	Spiral End Mill (Coarse Tooth), 3-4" dia., L.H.,
	No. 7 taper.
No. E724	Spiral End Mill (Coarse Tooth), 1" dia., L.H.,
	No. 7 taper.
No. E732	Spiral End Mill (Coarse Tooth), 1 1-4" dia., L.H.,
No Feos	No. 7 taper. Slotting End Mill (Two Linned) 3.8" dig L H
NO. 12002	No 7 taper
No. E604	Slotting End Mill (Two Lipped), 1-2" dia., L.H.,
	No. 7 taper.
No. F128	Spiral Shell End Mill, 3" dia., 2 1-4" face, 1" hole.
No. J25	60° Angular Cutter, R.H., 1 1-4" dia., 7-16" thick,
N. TOP	3-8"-20 L.H. nole.
NO. J23	28"-90 I. H hole
Weight m	andy for shipment about 40 lbs Price \$
weigne, i	cauy for shipment, about to this. Trice, o
-	O O & F Trantical Quindle Willing Macha
For Nos	3. 2, 3 & 5 Vertical Spindle Milling Machs.
No. 146	Screw Arbor, 1 1-4" dia., 8 thds., L.H., No. 11 taper.
	2" Screw Arbor Wrench.
No 1717	Spiral End Mill (Coarse Tooth) 34" dia T.H.

- NO. E717 Ena Mill (Coarse No. 9 taper.
- No. E725
- Spiral End Mill, 1" dia., L.H., No. 9 taper. Spiral End Mill (Coarse Tooth), 1 1-4" dia., L.H., No. E733 No. 9 taper. Spiral End Mill (Coarse Tooth), 1 1-2" dia., L.H.,
- No. E737 No.9 taper.
- Coarse Tooth Spiral Shell End Mill, 3" dia., 1 3-4" No. F201 face, 1 1.4"-8 L.H. hole.
- 60° Angular Cutter, 4" dia., 1 1-4" face, 1 1-4"-8 No. J27 L.H. hole.
- Inserted Tooth Face Mil'g Cut'r, 9" dia., 3 3-4" face. No. 55
- Inserted Tooth Face Milling Cutter Sleeve, hole 4" No. 9 dia., 3 thds., L.H. Inserted Tooth Face Milling Cutter Clamping Plate.
- No. 5
- Inserted Tooth Face Milling Cutter Bolt and Nut. No. 9*.
- Inserted Tooth Face Milling Cutter Bolt and Nut. Inserted Tooth Face Milling Cutter Bolt and Nut. No. 5**
- No. 3†
- Weight, ready for shipment, about 60 lbs. Price, \$

List continued on next page.

^{**} No. 3 Machine only. * No. 2 Machine only. † No. 5 Machine only.

MILLING MACHINE CUTTER ARBORS.						
B.4 S.MF	Style A	<u>.</u>	BAIL MICO	sty	yle B.	
	B.Z. S. MP G		Style C	•		
	B.4.5.N	raco.	Style I).		
B.4 S.MFG PROVIS			Style E			
No. of Arbor,	No. of Taper Shank.	Dia. of Arbor,	Length Shoulder to Nut.	Dia. of Hardened Sleeve.	Style.	Price.
$\begin{matrix} 04\\05\\07\\08\\09\\010\\0'1\\012\\1\\6\\7\\18\\9\\10\\11\\1^{12}\\13\\40\\41\\1^{42}\\43\\445\\445\\445\\445\\445\\16\\17\\18\end{matrix}$	7 7 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	$\begin{array}{c} 1.2'' \\ 1.2 \\ 5.8 \\ 7.8 \\ 1 \\ 5.8 \\ 7.8 \\ 1 \\ 5.8 \\ 7.8 \\ 1 \\ 1.16 \\ 1.4 \\ 7.8 \\ 1 \\ 1.16 \\ 1.4 \\ 7.8 \\ 1 \\ 1.16 \\ 1.4 \\ 7.8 \\ 1 \\ 1.16 \\ 1.4 \\ 7.8 \\ 1 \\ 1.16 \\ 1.4 \\ 7.8 \\ 1 \\ 1.16 \\ 1.4 \\ 1.4 \\ 7.8 \\ 1 \\ 1.16 \\ 1.4 \\ 1.$	$\begin{array}{c} 1'' \\ 3 \\ 4 \\ 5 \\ 1.4 \\ 5 \\ 1.4 \\ 8 \\ 8 \\ 8 \\ 8 \\ 8 \\ 8 \\ 4 \\ 5 \\ 1.4 \\ 5 \\ 1.4 \\ 5 \\ 1.4 \\ 5 \\ 1.4 \\ 5 \\ 1.4 \\ 5 \\ 1.4 \\ 5 \\ 1.4 \\ 10 \\ 1.4 \\ 10 \\ 1.4 \\ 10 \\ 1.4 \\ 10 \\ 1.4 \\ 10 \\ 1.4 \end{array}$	1 13-16" 1 13-16 1 13-16	A A A A A A A A A A A A A A A A A A A	$\begin{array}{c} \$3 50 \\ 4 00 \\ 4 50 \\ 5 00 \\ 5 00 \\ 6 50 \\ 6 50 \\ 6 50 \\ 6 50 \\ 6 50 \\ 6 50 \\ 6 00 \\ 6 00 \\ 6 00 \\ 6 00 \\ 6 00 \\ 7 50 \\ 7 50 \\ 7 50 \\ 7 50 \\ 7 50 \\ 7 50 \\ 7 50 \\ 7 50 \\ 7 50 \\ 11 50 \\ 12 50 \\ 12 50 \\ 12 50 \\ 13 0 \\ 9 0 \\ 0 \\$

List continued on next page. † These Arbors are not carried in stock, but can be furnished at short notice. Standard Taper Holes, page 85

MILLING MACHINE CUTTER ARBORS.

No. of Arbor.	No. of Taper Shank.	Dia. of Arbor.	Length Shoulder to Nut.	Dia. of Hardened Sleeve.	Style.	Price.
48	11	7-8"	16 1-4"	2 1-16"	В	\$13 50
49	11	1	17 3-4	2 1-16	B	13 50
+50	11	1 1.16	17 3.4	2 1-16	B	13 50
51	11	114	20 1 1	2 1 16	B	15 00
50	11	1 1 9	20 14	2 1 16	B	15 00
40 4	11	1 1-4	10 1.4	0 1 16	r C	15 50
48-A	11	1 1-0	10 1-4	0 1 16	č	15 50
49-A	11	1 1 10	17 0-4	2 1-10	č	10 00
750-A	11	1 1-10	1/ 3-4	2 1-10	C	10 00
51-A	11	1 1-4	20 1-4	2 1-10	C	17 00
52-A	11	1 1-2	20 1-4	2 1-16	C	17 00
35	11	7-8	16	2 1-16	Ď	15 00
36	11	1	16	2 1-16	D	15 00
137	11	1 1-16	16	2 1-16	D	15 00
38	11	1 1-4	19 1-2	2 1-16	D	16 00
39	11	1 1-2	19 1-2	2 1-16	D	16 00
35-A	11	7-8	16	2 1-16	E	17 00
36-A	11	1	16	2 1-16	E	17 00
137-A	11	1 1-16	16	2 1-16	E	17 00
38-A	11	11-4	19 1-2	2 1-16	Е	18 00
39. A	11	1 1.2	19 1-2	2 1-16	Ē	18 00
65	11	1	22	2 5-16	D	16 50
66	11	114	26 3 4	2 5.16	Ď	17 50
67	11	1 1 9	26 3 4	2 5 16	Ď	17 50
60	11	1 2 1	96 3 4	9 5 16	Ď	17 50
10 4	11	1 0-1	20 0-1	2 1 16	Ē	18 00
19-A	11	1 1-0	20	9116	F	18 50
401 A	11	1 1 1 1 6	20	0 1 16	T	18 50
121-A	11	1 1-10	24	0 1 10	TT.	10 00
22-A	11	1 1-4	24	0 1 10	TA	10 00
23-A	11	1 1-2	24	2 1-10	E	19 00
65-A	11	+	22	2 9-16	E	10 50
66-A	11	1 1-4	26 3-4	2 5-16	E	19 50
67-A	11	1 1-2	26 3-4	2 5-16	E	19 00
68-A		1 3-4	26 3-4	2 5.16	E	19 00
69	12	1	25	2 9-16	D	17 00
70	12	11-4	29	2 9-16	Ď	18 00
71	12	1 1-2	- 29	2 9-16	D	18 00
71 1-2	12	1 3-4	29	2 9-16	D	18 00
72	12	2	29	2 9-16	D	18 00
69-A	12	1	25	2 9-16	E	19 50
70-A	* 12	1 1-4	29	2 9-16	E	20 50
71-A	12	1 1-2	29	2 9-16	E	20 50
71 1-2-A	12	1 3-4	29	2 9-16	E	20 50
72-A	12	2	29	2 9-16	E	20 50
75-A	12	1	30	2 9-16	E	21 00
76-A	12	11-4	35	2 9-16	E	22 00
77-A	12	11.2	35	2 9-16	E	22 00
78-A	12	1 3.4	35	2 9-16	Ē	22 00
79-A	12	2	35	2 9-16	Ē	22 00

†These Arbors are not carried in stock, but can be furnished at short notice. Standard Taper Holes, page 85.

MILLING MACHINE SCREW ARBORS and Arbors for Coarse Tooth Shell End Mills.

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Style C.

Style D. Similar to Style C, but has threaded hole in end for drawing-in bolt.

No. of Arbor.	No. of Taper.	Dia. of Arbor.	Thread.	Style.	Price.
$\begin{array}{c} 120\\ 122\\ 128\\ \dagger 129\\ 130\\ \ast 131\\ \dagger^{\ast}132\\ 133\\ \dagger 134\\ 135\\ 138\\ \dagger 139\\ 142\\ \dagger 143\\ 146\\ \dagger 147\\ 150\\ \dagger 151\\ 154\\ \dagger 155\\ 158\\ \dagger 159\\ 162\\ \end{array}$	$\begin{array}{c} 7\\ 9\\ 10\\ 10\\ 10\\ 10\\ 11\\ 12\\ 11\\ 11\\ 11\\ 11\\ 11\\ 12\\ 12\\ 12$	$\begin{array}{c} 3.8''\\ 1.2\\ 1\\ 1\\ 1\\ 1\\ 1\\ 1\\ 1\\ 1\\ 1\\ 1\\ 1\\ 1\\ 1\\$	20, 16, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10	AABBBDDCCCCDDCCCDDCCCD	\$2 00 3 00 5 50 5 50 5 50 5 50 7 00 9 00 7 00 8 00 8 00 8 00 9 00 9 00 9 00 9 00 9 00 9 00 9 00 9 00 8 00 9 00 8 0

List continued on next page. * Does not have clutch drive. Standard Tapers, page 85. †These Arbors are not carried in stock, but can be furnished at short notice. In ordering, state whether Right or Left Hand Arbors are wanted.

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MILLING MACHINE SCREW ARBORS and Arbors for Coarse Tooth Shell End Mills.

(CONTINUED)

No. of Arbor.	No. of Taper,	Dia. of Arbor,	Thread.	Style,	Price.
†163 166 †167 170 † 1 71	11 12 12 12 12 12	$ \begin{array}{r} 1 1.2'' \\ 1 1.2 \\ 1 1.2 \\ 1 1.2 \\ 1 1.2 \\ 1 1.2 \\ 1 1.2 \\ \end{array} $	8, R. 8, L. 8, R. 8, L. 8, R. 8, R.	D C C D D	\$8 00 9 00 9 00 9 00 9 00 9 00

†These Arbors are not carried in stock, but can be furnished at short notice. In ordering, state whether Right or Left Hand Arbors are wanted. Standard Tapers, page 85.

ARBORS FOR SHELL END MILLS.



Style B.

No. of Arbor,	No. of Taper.	Dia. of Arbor.	Diameter Mills Arbor will take.	Style.	Price.
89	.7	1-2"	1 1-4" to 1 1-2"	A	\$4 50
90	9	3-4	1 9-16 " 2 3-16	A	4 50
91	9	1	2 1-4 " 3	A	4 75
92	9	1-2	11.4 "11.2	B	4 50
93	9	1-2	11.4 "11.2	A	4 50
96	9	3-4	1 9-16 ** 2 3-16	B	4 50
105	9	1	2 1-4 " 3	B	4 75
94	10	3-4	1 9-16 " 2 3-16	A	5 25
95	10	1	2 1.4 " 3	A	5 50
97	10	3-4	1 9-16 " 2 3-16	B	5 25
98	10	1	21.4 " 3	B	5 50
99	11	3-4	1 9-16 " 2 3-16	A	5 50
100	11	1 1 12	21.4 " 3	A	5 75
101	11	3-4	1 9-16 " 2 3-16	B	5 50
102	11	1	21.4 " 3	B	5 75
103	12	3-4	1 9-16 " 2 3-16	B	6 00
104	12	1	21-4 "3	B	6 25

In ordering, state whether Arbor is for R.H. or L.H. Mill. Morse Taper furnished when desired. Standard Tapers and Taper Holes, page 85. List of Mills, pages 342 and 343.





Style D. Similar to Style C, but no threaded hole.

No. of Arbor.	No.of Taper of Shank.	No. of Taper for Mill.	Style.	Price.
79	10	10	A	\$8 00
80	11	10	C	12 00
81	11	12	В	10 00
82	11	12	A	10 00
83	11	12	C	12 00
84	11	12	D	12 00
85	12	12	D	12 00
86	12	10	C	12 00
87	12	12	C	12 00

Standard Tapers and Taper Holes, page 85.



These Arbors are for use with Screw Slotting Cutters and are adapted for use on Centres. They are also made with No. 7 Taper Shank for use on the Screw Slotting Machines. The following sizes are carried in stock: 3-8", 1-2", 5-8", 3-4", 7-8", 1". Price, each, \$3 50.

For List of Screw Slotting Cutters, see pages 347 and 348.

FLY CUTTER ARBORS

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For Milling Machines.



The hole in the head is 3-4" square.

No. of Arbor.	No. of Taper,	Price.
110	10 .	\$6 50
112	11	8 00
113	12	9 00

Price includes tool with 1-8" radius. Standard Taper Holes, page 85.

INDEX PLATES

For Use on Universal Milling Machines.

No.	Machine where used.	Diam. of Plate.	Hole in Centre.	Number of Holes in Each Circle,					Price.	
1 2 3	No. 1 Prior to 1900	4 3.4" 4 3.4 4 3.4	1 1-8" 1 1-8 1 1-8	15 21 37	16 23 39	17 27 41	18 29 43	19 31 47	20 33 49	\$2 50 2 50 2 50
7 8 9	$ \Big\} {}^{\text{Nos.1,1A,}}_{1\text{D, 1AD,}} \Big\{ \\ {}^{\text{Nos.1,1A,}}_{2 \& 2\text{A}} \Big\{ \Big\} $	5 5 5	1 1-8 1 1-8 1 1-8	$ \begin{array}{c} 15 \\ 21 \\ 37 \end{array} $	16 23 39	17 27 41	$ \begin{array}{r} 18 \\ 29 \\ 43 \end{array} $	19 31 47	20 33 49	$ \begin{array}{c} 2 50 \\ 2 50 \\ 2 50 \end{array} $
13 14 15	2A Hvy. 3 & 3A	$ \begin{array}{r} 6 \ 1.4 \\ 6 \ 1.4 \\ 6 \ 1.4 \end{array} $	${\begin{array}{c}1 & 1-2 \\ 1 & 1-2 \\ 1 & 1-2 \\ 1 & 1-2 \end{array}}$	$ \begin{array}{r} 15 \\ 21 \\ 37 \end{array} $	16 23 39	17 27 41	18 29 43	19 31 47	20 33 49	3 50 3 50 3 50
$20 \\ 21 \\ 22$	No. 4 Prior to 1893	$\begin{array}{c} 6 & 15\text{-}16 \\ 6 & 15\text{-}16 \\ 6 & 15\text{-}16 \end{array}$	$egin{array}{c} 1 & 1\end{array}{c} 1 & 1\en$	15 21 37	16 23 39	17 27 41	18 29 43	19 31 47	20 33 49	$\begin{array}{c} 3 & 50 \\ 3 & 50 \\ 3 & 50 \end{array}$
28 29 30	3A Hvy. 4A & 4A Hvy.	$\begin{array}{c c} 7 & 1-2 \\ 7 & 1-2 \\ 7 & 1-2 \\ 7 & 1-2 \end{array}$	$\begin{array}{c c}1&3.4\\1&3.4\\1&3.4\\1&3.4\end{array}$	15 21 37	16 23 39	17 27 41	18 29 43	19 31 47	20 33 49	3 50 3 50 3 50



Style 3.

Style 4.

Style 2A. Similar to Style 2, but no threaded hole. Style 3A. Similar to Style 3, but no threaded hole. Style 4A. Straight hole through; front end 60° taper.

Mark.	Outside Taper.	Inside Taper.	Style.	Collet to Spindle.	Diameter of Threaded Hole.	Price.
LL	6	2	4	3-4"	The state of the state of	\$1 50
A	7	4	1	1 9-16		2 00
J	7	4	2	5-16	3-8", 16, L. H.	2 00
N	7	5	1	2 5-16	M. Barren and Married	2 00
R	7	5	2	3.4	3-8, 16, L. H.	2 00
C	9	5	1	21.8		3 00
D	9	5	1	3.8	a las de la serie	2 75
K	9	5	2	3-8	7-16, 14, L.H.	2 75
KK	9	7	1	3-4		3 25
RR	9	7	2	7-8	7-16, 14, L. H.	3 25
EE	10	5	1	21-8		3 50
MM	10	6	4A	3.4	here the second second	3 50
DD	10	7	1	2 5-8	113 00 0481	3 50
E	10	7	1	1 5-8	And the second second	3 50
BB	10	7	2	11-4	1-2, 14, L. H.	4 00
Z	10	7	2A	1-2	antal-L. Juliation	3 50
F	10	9	1	1	15 TO THE TRANSPORT	4 00
FF	10	9	2	1 1-4	1-2, 14, L. H.	4 00
Q	11	7	1	1 3-4		4 50
Ğ	11	9	1	2 3-8		5 00
0	11	9	2	1.4	3-4, 12, L.H.	5 25
H	11	9	3	1 5-8	3-4, 12, L. H.	6 00
GG	11	10	3A	1-2		6 00
SS	12	9	2	7-16	3-4, 12, L. H.	6 00
T	12	. 9	3A	1 11-16	and a shall have	6 50
V	12	10	2	7-8	3-4, 12, R. H.	6 50
P	11	10	1	1 3-8		6 50
PP	12	10	3A	1 11-16	AN C. J. MARK	6 50
VV	12	11	2	17-8	3-4, 12, R. H.	6 50
TT	12	11	3A	1 11-16		6 50
UU	12	9	3	1 11-16	3-4, 12, L. H.	6 75
WW	14	10	2	7-8	3-4, 12, R. H.	8 00
W	14	11	2	7-8	3-4, 12, R. H.	8 00
WV	14	12	2	7-8	3-4, 12, R. H.	8 00
XX	16	11	2	7-8	7-8, 10, R. H.	10 00
X	16	12	2	7-8	7-8, 10, R. H.	10 00
YY	18	11	2	7-8	1, 10, R. H.	11 50
Y	18	14	2	7-8	1, 10, R. H.	13 00

Standard Tapers and Taper Holes, page 85.



Price includes Turning Plug and Knockout Key.

Diameter.	Length over all.	No. of Taper Hole	Price.		
3-4"	5 1-4"	4	\$1 50		
11-8	8 1-2	5	2 00		
1 5-8	10	7	2 50		
1 5-8	12	9	3 50		
2	14	10	4 50		

STANDARD TAPER HOLES.

To find the number of taper hole in spindle, measure the diameter of large end of hole and the corresponding taper may be found in the following list.

No. of Taper.	Approximate Diam. at Large End.	No. of Taper.	Approximate Diam at Large End.
6	19-32"	12	1 13-16"
7 9	23-32 1 1-16	14 16	2 11-32 2 7-8
10 11	1 9-32 1 17-32	18	3 7-16

STANDARD TAPERS

FOR SPINDLES, COLLETS, ARBORS, &c.

No. of Taper -1 2 3 4 5 6 7 8 9 Dia. at small end -.20'' .25''' .312''' .35''' .45''' .50''' .60'' .75'' .90''

No. of Taper — 10 11 12 13 14 15 16 17 18 Dia. at small end — 1.045" 1.25" 1.50" 1.75" 2" 2.25" 2.50" 2.75" 3"



This Chuck is found convenient for holding wire, small rods, straight shank drills, mills, etc. The Collet Holder is of steel, ground to fit a standard taper hole, and has a hole its entire length. The spring collet is held in place by a cap nut that forces it against the taper seat and closes the chuck centrally.

No. of Chuck.	No. of Out- side Taper.	Hole Thru.	Machines where used.	Round Collet Furn.	Price.						
150	7	5-16"	0 & 1 Vert. Spind. Att. (1 Comp.&1 Unv.Mill.Att. (1-4″	\$9 00						
152	9	1-2	6 Univer. Index Centres	5-16	9 00						
154	10	21-32	1,1A,1D,1AD,2 & 2A Un. 1,1B,1Y,1D,1BD,2,2B and 2Y Plain. 1 Vertical Spindle 10" & 12" Plain & 10" Univ.	3-8	11 00						
156	11	3-4	(Index Centres 2A Hvy, 3, 3A, 3A Hvy. and 4A Universal 2 Heavy, 2B Heavy, 3, 3B 3B Heavy and 4B Plain 2, 3 & 5 Vertical Spindle	5-8	12 00						
158	12	1	4A Heavy Universal4B Hvy. & 5B Hvy. Plain12 1-2" Univ. Index Cen.	5-8	13 50						
	1	Sta	ndard Taper Holes, page 85.	Side Side							
For No SC For N 9. SC For N 9. SC HC For N SC SC	PRIN 5. 150 7 32ds 10 are 01 0. 154, 16", 5-8' 10 are, 20 a	G C(and 15 r Hexa Round ' 3-16" a al, 1-4' and 15 9-16" to 1-4", 5-	DLLETS for Milling M 2, Round, 1-16" to 1-2", gonal, made to order rid, 1-8" to 1-2", by 32ds; nd 1-4", 'and 5-16", 8, Round, 3-16" to 1-2", 01", by 16ths, 6", 8.8", 7-16",	achin ce, eac ce, eac ce, eac ce, eac ce, eac ce, eac	e5. h, \$2 25 h, \$4 50 h, \$2 75 h, \$1 50 h, \$1 50 h, \$1 50 h, \$3 00 h, \$4 75						
H	Hexagonal, 1-4", 5-16", 3-8", 7-16", 1-2", Price, each, \$4 75										

Other sizes made to order.

TAPER MANDRELS AND EXPANSION BUSHINGS.



TAPER MANDRELS.

Man- drel No.	Whole Length.	Diam. at Small End.	Price.	Man- drel No.	Whole Length.	Diam. at Small End.	Price.
3 4 5 6 7 8	$\begin{array}{r} \hline 3 & 11 - 16'' \\ 4 & 1 - 16 \\ 4 & 1 - 2 \\ 5 & 1 - 8 \\ 5 & 15 - 16 \\ 6 & 9 - 16 \\ \hline \end{array}$	$\begin{array}{r} .3125''\\ .35\\ .45\\ .50\\ .60\\ .75\end{array}$	$$1 40 \\ 1 50 \\ 1 65 \\ 1 80 \\ 2 00 \\ 2 25$	$9 \\ 10 \\ 11 \\ 12 \\ 13$	7 3-16" 7 3-4 8 3-8 9 9 5-8	$\begin{array}{r} .90'' \\ 1.05 \\ \cdot 1.25 \\ 1.50 \\ 1.75 \end{array}$	

Mandrels take Bushings as follows: No. 3, 2 sizes; Nos. 4, 5, 6, 7 and 8, 3 sizes; Nos. 9, 10, 11, 12 and 13, 6 sizes.

EXPANSION BUSHINGS.

Outside Diam. of Bushing.	Length.	For Mndrl. No.	Price.	Outside Diam. of Bushing.	Length.	For Mndrl. No.	Price.
$\begin{array}{r} \underline{\text{Bushing.}}\\ \underline{\text{Bushing.}}\\ 1\text{-}2'' \\ 9\text{-}16 \\ 5\text{-}8 \\ 11\text{-}16 \\ 3\text{-}4 \\ 13\text{-}16 \\ 7\text{-}8 \\ 15\text{-}16 \\ 1 \\ 1\text{-}16 \\ 1 \\ 1\text{-}8 \\ 1 \\ 3\text{-}16 \\ 1 \\ 1\text{-}4 \\ 1 \\ 5\text{-}16 \\ 1 \\ 3\text{-}8 \\ 1 \\ 7\text{-}16 \\ 1 \\ 3\text{-}8 \\ 1 \\ 7\text{-}16 \\ 1 \\ 3\text{-}8 \\ 1 \\ 7\text{-}16 \\ 1 \\ 3\text{-}8 \\ 1 \\ 1\text{-}2 \\ 1 \\ 9\text{-}16 \\ 1 \\ 3\text{-}4 \\ 1 \\ 13\text{-}16 \end{array}$	$\begin{array}{c} 1 & 1-2'' \\ 1 & 5-8 \\ 1 & 3-4 \\ 1 & 7-8 \\ 2 & 1-4 \\ 2 & 3-8 \\ 2 & 1-4 \\ 2 & 3-8 \\ 2 & 1-2 \\ 2 & 5-8 \\ 2 & 3-4 \\ 2 & 7-8 \\ 3 & 1-8 \\ 3 & 1-4 \\ 3 & 3-8 \\ 3 & 1-8 \\ 3 & 1-4 \\ 3 & 3-8 \\ 3 & 5-8 \\ 3 & 3-4 \\ 3 & 7-8 \end{array}$	No. 334445555666677778888999999999999	$\begin{array}{c} \$0 55\\ 55\\ 65\\ 65\\ 65\\ 80\\ 80\\ 95\\ 95\\ 95\\ 115\\ 115\\ 115\\ 140\\ 140\\ 140\\ 140\\ 170\\ 170\\ 170\\ 170\\ 170\\ 170\\ 170\\ 17$	Bushing: 2" 2 1-16 2 1-8 2 3-16 2 1-4 2 5-16 2 3-8 2 7-16 2 9-16 2 9-16 3 1-2 2 9-16 2 9-16 3 1-2 1 3-16 3 1-16 3 1-8 3 3-16 3 1-4 3 5-16 3 1-4 3 5-16 3 1-4 3 5-16 3 1-4 3 5-16 3 1-4 3 5-16 3 1-2 2 9-16 2 9-2 3 -4 3 1-16 3 1-2 3 1-2 9 9-2 9 9-2 9 9 9-2 9 9 9 9 9 9 9 9 9 9 9 9 9	$\begin{array}{c} 4\\ 4\\ 4\\ 1.8\\ 4\\ 1.8\\ 4\\ 1.4\\ 4\\ 3.8\\ 4\\ 1.4\\ 4\\ 3.8\\ 4\\ 1.2\\ 4\\ 1.2\\ 4\\ 5.8\\ 4\\ 1.2\\ 4\\ 5.8\\ 4\\ 4\\ 5.8\\ 4\\ 4\\ 5.8\\ 4\\ 4\\ 7.8\\ 5\\ 5\\ 5\\ 5\\ 1.8\\ 5\\ 5\\ 5\\ 5\\ 5\\ 5\\ 5\\ 5\\ 5\\ 5\\ 5\\ 5\\ 5\\$	No. 10 10 10 10 10 10 10 11 11 11	\$2 00 2 00 2 00 2 00 2 00 2 40 2 40 2 40 2 40 2 40 2 40 2 80 2 80 2 80 2 80 2 80 2 80 3 20 3 20
1 15-16	4	10	2 00				



These Mandrels are of tool steel, hardened and accurately ground. They are tapered .0005" to one inch. The Mandrels from 1-4" to 1" are .0005" below size at the small end; and from 1 1-6" to 4" .001" below size at the small end.

Diameter.	Total Length.	Price.	Diameter.	Total Length.	Price.
$\begin{array}{c} 1.4''\\ 5.16\\ 3.8\\ 7.16\\ 1.2\\ 9.16\\ 5.8\\ 11.16\\ 3.4\\ 13.16\\ 7.8\\ 15.16\\ 1\\ 1.4\\ 15.16\\ 1\\ 1.4\\ 15.16\\ 1\\ 3.8\\ 1\\ 7.16\\ 1\\ 1.2\\ 1\\ 9.16\\ 1\\ 5.8\\ 1\\ 11.16\\ 1\\ 3.4\\ 1\\ 13.16\\ 1\\ 7.8\\ 1\\ 15.16\\ 2\\ 2\\ 1.16\\ 2\\ 1.8\\ \end{array}$	$\begin{array}{c} 3 & 1-2'' \\ 3 & 15-16 \\ 4 & 3-8 \\ 4 & 13-16 \\ 5 & 1-4 \\ 5 & 11-16 \\ 6 & 1-8 \\ 6 & 9-16 \\ 7 \\ 7 & 3-8 \\ 7 & 3-4 \\ 8 & 1-8 \\ 8 & 1-2 \\ 8 & 7-8 \\ 9 & 1-4 \\ 9 & 5-8 \\ 10 \\ 3-8 \\ 10 \\ 3-8 \\ 10 \\ 3-8 \\ 11 \\ 1-2 \\ 12 \\ 12 \\ 12 \\ 12 \\ 12 \\ 1$	0 65 75 85 95 105 115 125 135 145 155 170 185 200 210 220 230 245 260 275 290 310 330 350 370 390 410 435 460 480 515 560	$\begin{array}{c} 2 \ 3-16'' \\ 2 \ 1 \ 4 \\ 2 \ 5-16 \\ 2 \ 3-8 \\ 2 \ 7-16 \\ 2 \ 3-8 \\ 2 \ 7-16 \\ 2 \ 3-8 \\ 2 \ 12-16 \\ 2 \ 5-8 \\ 2 \ 13-16 \\ 2 \ 3-4 \\ 2 \ 13-16 \\ 3 \ 1-16 \\ 3 \ 3-8 \\ 3 \ 3-16 \\ 3 \ 1-2 \\ 3 \ 9-16 \\ 3 \ 5-8 \\ 3 \ 11-16 \\ 3 \ 5-8 \\ 3 \ 11-16 \\ 3 \ 5-8 \\ 3 \ 11-16 \\ 3 \ 5-8 \\ 3 \ 11-16 \\ 3 \ 5-8 \\ 3 \ 11-16 \\ 3 \ 5-8 \\ 3 \ 11-16 \\ 3 \ 5-8 \\ 3 \ 11-16 \\ 3 \ 5-8 \\ 3 \ 15-16 \\ 4 \\ \end{array}$	13'' 13 13 13 13 13 13 13 13	6 00 6 50 6 90 7 49 7 90 8 40 8 90 9 40 9 90 10 50 11 00 11 50 12 00 12 50 13 00 13 40 13 80 14 10 14 70 15 30 15 60 15 90 16 20 16 50 16 90 16 50 16 90 16 0 15 00 15 00 16 20 16 20 16 80 17 00 18 00

Nos. 1, 2, 3 and 4 HIGH SPEED MILLING ATTACHMENTS.

Patented Feb. 6, 1900. When ordering, give construction number of machine.



This Attachment consists of a bracket clamped to face of column and an internal gear screwed on to the machine spindle that meshes with a pinion upon the spindle of the Attachment.

The Spindle is hardened and ground and runs in a phosphor bronze bearing. The front end has a taper hole.

No.	Machine where used.	Commenc- ing with Machine No.	No. Taper Hole in Spindle.	Speeds per Minute.	Price.
1	(1 Universal 1A Universal 1D Universal 2 Universal 2A Universal 2A Universal 1 Plain 1B Plain 1D Plain	$\begin{array}{r} 2191 \\ 2191 \\ 539 \\ 539 \\ 1505 \\ 1505 \\ 1505 \\ 684 \\ 684 \\ 684 \\ 3 \\ 3 \end{array}$		$\begin{array}{r} 230-1617\\ 214-2228\\ 412-1659\\ 443-1961\\ 412-1659\\ 448-1961\\ 230-1617\\ 230-1617\\ 214-2228\\ 412-1659\\ 442-1961\\ \end{array}$	\$
	1BD Plain2 Plain2B Plain2Y Plain(2A Heavy Univ.2 Universal	$ \begin{array}{r} 5 \\ 1063* \\ 1063* \\ 1313 \\ 2055 \\ 650 \end{array} $	444455	$\begin{array}{r} 443-1301\\ 412-1659\\ 443-1961\\ 412-1659\\ 405-1755\\ 382-1975\end{array}$	
2	3A Universal 2 Heavy Plain 2B Heavy Plain 3 Plain 3B Plain	$ \begin{array}{c c} 650 \\ 963 \\ 982 \\ 549 \\ 54$	55555	$\begin{array}{r} 405 - 1755 \\ 382 - 1975 \\ 405 - 1755 \\ 382 - 1975 \\ 382 - 1975 \\ 405 - 1755 \end{array}$	\$
3	3A Heavy Univ. 4A Universal 3B Heavy Plain 4B Plain	$525 \\ 710 \\ 424 \\ 479$	5 5 5 5	$\begin{array}{c} 382 - 1665 \\ 382 - 1665 \\ 382 - 1665 \\ 382 - 1665 \\ 382 - 1665 \end{array}$	}\$
4	4A Heavy Univ. B Heavy Plain	635 384	5	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	\$

*Except 1098 to 1108 inclusive.



of machine.

This Vertical Spindle Milling Attachment is suitable for the lighter class of milling. The holder or frame is securely fastened to the overhanging arm, and the horizontal shaft is inserted in the spindle of the machine. The vertical spindle is driven by the horizontal shaft through a worm and wheel.

The Spindle can be set at any angle from a vertical to a horizontal position, the position being indicated by graduations on the base of the spindle head. The spindle has a taper hole; and the bearings are of bronze provided with means of compensation for wear.

A drawing-in bolt is furnished for holding collets, etc., in the spindle.

Weights. Net, No. 0, 60 lbs.; No. 1, 77 lbs.; No. 2, 102 lbs.; ready for shipment, No. 0, 69 lbs.; No. 1, 95 lbs.; No. 2, 130 lbs.

No.	Machine where used.	Taper ein Spl.	Centre to Face of	Centre Spindle to Face of Column.			peeds per inute.	rice.
		No. Hold	Least.	Greatest.	Cen Spl. Ati	0	M	H
01	00 Plain. 0, 0Y Plain.	7	3 1-4"	12″	3 7-16"	J	363-1455 262-1047 114-800	\$
1	1 A Universal 1B Plain 1D, 2 Univ. 1AD Univer. 2A Universal 1D, 2, 2Y Pl. 1BD Plain	7	4 3-8	14 1-4	4 1-8	J	$\begin{array}{c} 114-300\\ 106-1103\\ 106-1103\\ 41-821\\ 39-971\\ 39-971\\ 41-821\\ 39-971\\ \end{array}$	\$
2	2B Plain 2A Hvy. Univ. 3 Universal. 3A Universal 2 Heavy Pl. 2B Heavy Pl. 3 Plain. 3B Plain	9	5	19	4 3-4	ĸ	$\begin{array}{r} 39-971\\ 33-755\\ 25-850\\ 33-755\\ 25-850\\ 33-755\\ 25-850\\ 33-755\\ 33-755\end{array}$	}\$



When ordering, give size and construction number of machine.

This Attachment, designed for the heavier class of vertical spindle milling, is rigidly clamped to the overhanging arm and face of the column.

The Spindle is of steel, ground, and runs in bronze boxes provided with means of compensation for wear. It is offset to the left of the machine spindle, allowing the cutter to be brought close to the centre of the Spiral Head elevated to a high angle. The spindle is driven by hardened steel spur and bevel gears. It can be set at any angle from a vertical to a horizontal plane, the position being indicated by graduations reading to half degrees. A drawing in bolt is furnished for holding collets, etc., in the spindle. No. 2 H Attachment has slot across end of spindle.

Net Weights: No. 1H, 145 lbs.; No. 2H, 215 lbs.

No. of Attachmnt.	Used on Machine.	Commenc g with Mach. No.	No. Taper Holein Spl.	Thread on Spindle.	Centre of Spdl to face of Column	Centre Mch Spl. to End Att. Spdl.	Centre Mch Spl. to Cen. Att. Spdl.	Speeds per Minute.	Price.
1H	1 Universal 1A Univ. 1D Univ. 1AD Univ. 2 Univ. 2A Univ. 1 Plain 1Y Plain 1B Plain 1D Plain 1BD Plain 2 Plain 28 Plain 28 Plain	2191 2191 539 539 1505 1505 684 859 684 3 3 1063* 1212	10	2½″, 4 L.H.	10¾″	2″	334"	$\begin{array}{c} 44-310\\ 41-427\\ 16-318\\ 15-376\\ 16-318\\ 15-376\\ 44-310\\ 44-310\\ 44-310\\ 44-310\\ 41-427\\ 16-318\\ 15-376\\ 16-318\\ 15-376\\ 16-318\end{array}$	*
2H	3 Universal 3A Univ. 2 Hvy. Plain 2B Hvy.Pln. 3 Plain 3B Plain	650 650 963 982 549 549	11	$3\frac{1}{4}$ ", $3\frac{1}{2}$ L.H.	11	2½	4	$\begin{array}{r} 13-439\\ 17-390\\ 13-439\\ 17-390\\ 13-439\\ 13-439\\ 17-390\end{array}$	\$

* Except Nos. 1098 to 1108 inclusive.

The following collets are furnished with the attachments: 1H, BB; 2H, O.



Nos. 3, 4, 5, 24 VERTICAL SPINDLE MILLING **ATTACHMENTS**



When ordering give size and construction number of machine.

This Vertical Spindle Milling Attachment is designed for the lighter class of vertical spindle milling on heavy machines. It is clamped securely to the overhanging arm and, in addition, is held by a bearing surface on face of column.

The spindle is driven by hardened steel bevel gears and is of steel, ground, and runs in bronze boxes provided with means of compensation for wear. It can be set at any angle from a vertical to a horizontal plane, the position being indicated by graduations reading to degrees.

A drawing-in bolt is furnished for holding collets, etc., in the spindle.

Attachmnt.	Used on Machine	Commencg with Mach. No.	No. Taper Holein Spl.	Thread on Spindle.	Centre of Spdl to face of Column.	Spl. to End Att. Spdl.	Speeds per Minute.	Net Weight 1bs.	Price.
3	3A Hvy. Un. 4A Univ. 3B Hvy.Pln. 4B Plain	$525 \\ 710 \\ 424 \\ 479$	}10	2½", 4 L. н.	11″	6¼″	16–370	130	\$
4	4A Hvy. Un. 4B Hvy.Pln.	635 384	{ 10	2½", 4 L. H.	$12\frac{1}{2}$	6¼	15-350	142	\$
5	5B Hvy.Pln.	281	10	2½", 4 L. H.	$12\frac{1}{2}$	6¼	14-330	145	\$
*24	24 Plain	175	9	2½", 4 L. H.	9½	6^{13}_{16}	24-157	125	\$

*Is different in design than cut.

The following collets are furnished with the attachments : Nos. 3, 4 and 5, BB; No. 24, K.

Nos. 3H, 4H and 5H VERTICAL SPINDLE MILLING ATTACHMENTS.

When ordering, give construction number of machine.



This Attachment is designed to meet the requirements of the heaviest class of vertical milling within the capacity of the machines for which it is adapted. It is securely clamped to the face of the column, the outer end being rigidly supported by braces clamped to the regular arm support.

The Spindle can be set at any angle from a vertical to a horizontal plane, the position being indicated by graduations reading to degrees on the side of the head. It is driven through hardened steel bevel and spur gears. It is of steel, ground, and runs in bronze boxes provided with means of compensation for wear, the lower box being unusually long and heavy. The lower end has a standard taper hole, threaded to receive face milling cutters, and has a recess across the end for arbors and collets that are clutch driven.

A drawing-in bolt is furnished for holding collets, etc., in the spindle. Weights. Net, No.3H, 375 lbs.; No.4H, 450 lbs.; No.5II,600 lbs.

No. of Attachmnt.	Machine where used.	Commene g with Mach. No.	No. Taper Hole in Spl.	Thread on Spindle.	Centre of Spdl to face of Column.	Centre Mch Spl. to End Att. Spdl.	Speeds per Min.	Price.
3H	3A Hvy. Univ. 4A Universal 3B Hvy. Plain 4B Plain	525 710 424 479	$\overline{\left. \right\}}$ 11	4", 3 LH	13″	53⁄8"	16-370	\$
411 }	4A Hvy. Univ. 4B Hvy. Plain	635 384	12	$4\frac{1}{2}'', 2\frac{3}{4}$ LH	14	53%	15-350	
5H	5B Hvy. Plain	281	1 12	41", 24 LH	16	1 5%	14-550	1

The following collets are furnished with the attachments: No. 3H. O; Nos. 4H and 5H, SS.

94 Nos. 1 and 2 COMPOUND VERTICAL SPINDLE MILLING ATTACHMENTS

Patented July 10, 1906.

When ordering, give size and construction number of machine.

The Compound Vertical Spindle Milling Attachment is applicable to a variety of milling in that it can be set in two planes.

The Spindle is driven through steel bevel gears by a horizontal shaft inserted in the main spindle of the machine and can be set to any angle from a vertical to a horizontal position. The attachment can be placed to allow the spindle to be set in a plane at right angles to the table, a valuable feature in milling angular strips, table ways, etc., as with the spindle in this position, the full length of the table travel is available and an ordinary end mill instead of an angular cutter can be used for milling the angle. The spindle bearings are of bronze and provided with means of compensation for wear. The position of the spindle is indicated by graduations reading to degrees. The spindle has a taper hole.

No. of ttachmt	Used on Machine.	Com- mencg with Mach.	fo. Taper Hole in Spindle	Dist Centre to face of	ance of Spdl of Colm	ntr Mch p. to end .tt. Spdl.	Speeds per Minute.	let Wght 1bs.	Price.
P			2.01	Gratst	lieast	Pao		4	-
1	1 Universal	2191			No.		78-552	in the second	1
	1A Univer.	2191	A. B. A.	idens u Ja		E. M. MOR	72-755	23/19	1.2.2.2
13.	1D Univ.	539	1.2.044		fill a di		28-565		1 Calls
	1AD Univ.	539	2				26-668	12	1.5 15
	2 Universal	1505	E. AL				28-565	14-1	141.3
12-1	2A Univ.	1505					26-668		1 100
1	1 Plain	684	7	12"	9"	5 1-4"	78-552	105	}\$
	1B Plain	684	11 × 12		1.	1. S.	72-755		
	ID Plain	3	1. 2.				28-565	18.191	13.00
6	IBD Plain	3	122	124	150.3	an luis	26-668	1997	1
	2 Plain	1063*	1.1.1.1		ESSE:		28-565	See 1	1.16
	2B Plain	1063*	1.1	Call and	4 3		26-668		121
ſ	2 I Plain	1313	1.1.1.1		145- S	122.07	28-565	1	J
1	2A HVY.UII.	2000	1000	N. USA	A. LEWE	Viela I	20-010	E LOS)
	3 Universal	650	12.		1.614	1 INTOTAL	19-040		1.18
2	9 Hyp Pl	063	0	19 1 9	019	5 2.4	10 646	190	0
1	2R HVV PI	1513	0	14 1-4	5 1-4	0 0 4	95 575	120	10
	3 Plain	519	1. 1. 1.	1	2.20	More 1.	10_646		1
	3B Plain	549	1.0		- Support	Carrie C	25-575	118 6	1
ALL ALL	o ~ ~ min	010	1. S	Le de la	- Aller		20 010 I		

*Except Nos. 1098 to 1108 inclusive.

The following collets are furnished with attachments: No. 1, J; No. 2, K.



The Spindle is driven through bevel gears by a horizontal shaft inserted in the main spindle of the machine and can be set at any angle in a vertical or horizontal plane. The position is indicated by graduations reading to half degrees. The bearings are of bronze and the front spindle bearing is provided with means of compensation for wear. A drawing-in bolt is furnished for holding collets, etc., in the spindle.

No. of Attachmnt.	Used on Machine.	Commencg with Mach. No.	Number Taper Hole inSpindle.	Thread on Spindle.	Centre of Spdl to face of Column.	Speeds per Minute.	Net Weght 1bs.	Price.
1	1 Universal 1A Univer. 1D Univ. 2 Universal 2A Univ. 1 Plain 1B Plain 1B Plain 1BD Plain 2 Plain 2 Plain 2 Y Plain 2 Y Plain 2 Y Plain	$\begin{array}{c} 2191\\ 2191\\ 539\\ 539\\ 1505\\ 1505\\ 684\\ 684\\ 684\\ 3\\ 3\\ 1063^*\\ 1063^*\\ 1313\\ 9055\\ \end{array}$	7		7 3-8″	$\begin{array}{c} 59-413\\ 55-569\\ 21-424\\ 20-500\\ 21-424\\ 20-500\\ 59-413\\ 55-569\\ 21-424\\ 20-500\\ 21-424\\ 55-569\\ 21-424\\ 35-798 \end{array}$	120	\$
**2-{	3 Universal 3A Univer. 2 Hvy. Plain 2B Hvy.Pln. 3 Plain 3B Plain 2A Hvy. Up	$\begin{array}{c} 650 \\ 650 \\ 963 \\ 982 \\ 549 \\ 549 \\ 525 \end{array}$	9		9 1-2	20-500 27-898 35-798 20-500	195	\$
3	3A Hvy. Ol. 4A Univ. 3B Hvy.Pln. 4B Plain	$ \begin{array}{c c} 323 \\ 710 \\ 424 \\ 479 \end{array} $	9	2", 4 1-2 L. H.	9 1-2	33-756	205	\$
4	24 Plain† 4A Hvy. Un. 4B Hvy.Pln.	175 635 384	9	2", 4 1-2 L. H.	10	30-715	240	\$

* Except Nos. 1098 to 1108 inclusive.

** No. 2 graduated on both scales to half degrees.

†Includes plate for supporting attachment on machine. Same plate will also serve for other attachments. Kindly state if plate is not needed.

The following collets are furnished with attachments: No. 1, J; Nos. 2, 3 and 4, K.

Nos. 0, 1, 2, 3, 4, 5 SLOTTING ATTACHMENTS.

When ordering, give size and construction number of machine.

The Slotting Attachment is well adapted for tool making of all kinds, as in forming box tools, making templates, splining keyways, etc.

The Tool Slide is driven from the main spindle of the machine by an adjustable crank that allows the stroke to be set at different lengths. The slide can be set at any angle between 0 and 90° either side of the centre line, the position being indicated by the graduations reading to half degrees on the side of the guide. A scale on the front of the tool slide serves to set the length of stroke.

CBD

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The Tools are held in place by a clamp bolt, and a tool stop that swings over the top of tool shank makes it impossible for the tool to be pushed through.

No. of Att.	Used on Machine.	Com- mencing with Machine No.	Diam. of Hole for Tool Shank.	Adjust- ment of Stroke	Face of Column to Centre of Tool Holder.	Net Weght 1bs.	Price.
0	0 & 0Y Pln.	895	1-2"	0 to 2"	6 7-8"	70	\$
ſ	1&1A Univ.	2191				N. Let)*
	2 & 2 A Univ.	1505		PIE 464	Port Ta	REATER	133-6
1	1&1BPlain.	684	1-2″	0 to 2"	7 1-8"	110	\$
	1D, 1BD Pl.	3					1
	2Y Plain	1313	and the	De Hain	1 Leave	3 1 10 1	1 2 10
Ì	2A Hvy. Un.	2055	S. F. K.		E Court	10.01	1
0	3 & 3A Univ.	650					
21	2 Hvy. Plain 2B Hyy Pla	963	5-8"	0 to 3"	8 1-4"	170	}\$
	3 & 3B Pln.	549	43.5 3.3	a v seuli		Such St.	
Ì	3A Hvy.Un.	525		Carlo Carl	1.	- 428 A. 2-	{
	4A Univ.	710	5.8"	0 to 3"	0 2 011	100	
3	3B Hvy.Pln.	424	0-0	0.000	0 0-0	190	\$
23	4D Flaint	479		T. W. Tare	201	12.2.1	1
1	44 Hyv IIn	625	A BERT		TUN	N TER	\$
4 }]	4B Hyv.Pln.	384	3-4"	0 to 4"	9 3-8"	270	1\$
5	5B Hvy.Pln.	281	3-4"	0 to 4"	12"	300	\$

† Except Nos. 1098 to 1108 inclusive.

[†]Includes plate for supporting attachments on machine. Same plate will also serve for other attachments. Kindly specify if plate is not needed.

SETS OF TOOLS FOR SLOTTING ATTACHMENTS.

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These tools are selected as those most fully meeting the requirements of the class of work on which the Slotting Attachments are usually employed.

A set of these tools is packed with each attachment. If not wanted, pack carefully and return at our expense.

For Nos. 0 and 1 Attachments.

3 Square Pointed Tools, 3-16", 1-4", 5-16"; Nos. 3, 4, 6.
4 Round Pointed Tools, 3-16", 1-4", 5-16", 3-8"; Nos. 11, 12, 14, 16.
1 Parting Tool, 1-8" wide; No. 20.
2 Angle Tools, 75°, 3-8", 5-16"; Nos. 22, 24.
1 Collet, No. 1.

Price, \$

For Nos. 2 and 3 Attachments.

3 Square Pointed Tools, 1-4", 5-16", 3-8"; Nos. 33, 34, 36.
4 Round Pointed Tools, 1-4", 5-16", 3-8", 1-2"; Nos. 41, 42, 44, 46.
1 Parting Tool, 1-8" wide, No. 50.
2 Angle Tools, 75°, 7-16", 3-8"; Nos. 52, 54.
1 Collet, No. 31.

For Nos. 4 and 5 Attachments.

3 Square Pointed Tools, 1-4", 3-8", 1-2"; Nos. 63, 64, 66.
4 Round Pointed Tools, 1-4", 3-8", 1-2", 5-8"; Nos. 71, 72, 74, 76.
1 Parting Tool, 1-6" wide, No. 80.
2 Angle Tools, 75°, 1-2", 5-8"; Nos. 82, 84.
1 Collet, No. 61.

Price, \$

Nos. 1, 2, 3, 4 RACK CUTTING ATTACHMENTS.



When ordering, give size and construction number of machine.

The Rack Cutting Attachment is unusually rigid in design and construction and is securely clamped to the face of the column. It is smoothly driven from the main spindle of the machine through hardened bevel and spur gears and runs in phosphor bronze boxes provided with means of compensation for wear.

Cutters suitable for use in the different attachments are as follows: Nos. 1, 2, 3 and 4 Attachments take the same cutters as are listed for the Nos. 3, 4, 5 and 6 Automatic Gear Cutting Machines. See pages 369, 371, 381 and 382. The Vise furnished with the Nos. 1 and 2 Attachments has jaws 26" long and will open 3"; with the Nos. 3 and 4 Attach-ments the vise has jaws 36" long and will open 4".

These Attachments are not suitable for machines without automatic transverse feed.

For Indexing Attachment see following page.

No. of	Used on Machine.	Com- menc g with	Dia. of Cutter	Distance Centre of Spindl. to	Cap Diame	acity trl Pitch	Weght 1bs.	Price.	
Att.		Nach.	Spinal	Spl. Head	Steel	Cast I.	IDS.		
1	1, 1A Univ. 1D, 1AD Un. 2, 2A Univ. 1, 1B Plain 1D, 1BD Pl.	$2191 \\ 539 \\ 1505 \\ 684 \\ 3$	1″	1 1-32"	6	5	165	\$	
2	2, 2B Plain 2A Hvy. Un. 3, 3A Univ. 2 Hvy. Plain 2B Hvy. Pln. 3, 3B Plain	$ \begin{array}{r} 1063 \\ 2055 \\ 650 \\ 963 \\ 1513 \\ 549 \end{array} $	1 1-4"	1 7-32"	5	4	227	\$	
3	3A Hvy. Un. 4A Univ. 3B Hvy.Pln.	525 710 424	1 1-2"	1 3-8″	4	3	353	\$	
4	4B Hvy. Un. 4B Hvy. Pln.	479 635 384	1 3-4″	1 5-8″	3	2	440	1\$	

*Except Nos. 1098 to 1108 inclusive.

99 INDEXING ATTACHMENTS.

ENGLISH OR METRIC.

For Use with Rack Cutting Attachments.

When ordering, give size and construction number of machine; also whether English or Metric Attachment is desired.



This Attachment consists of a bracket that is fastened to the table T slot at the left hand end. The bracket carries the locking disk, together with the change gears for gearing to the feed screw. It provides for cutting racks and making settings without relying on the dial usually used for this purpose.

Locking Disk. The locking disk is provided with a slot to receive the locking pin and is attached to the adjustable

stud on the bracket. Change Gears. Provide for cutting teeth as follows: English, diametral pitch, 3 to 6 by half-pitches, all pitches from 7 to 16, and all even pitches, 18 to 32; circular pitch, 1" to 1-16" by sixteenths of an inch; Metric, module I to 8; circular pitch, all pitches from 2 m/m to 16 m/m.

Index Table. Furnished with attachment.

gears.		SOCIO- INTO SO2	Letters and an inter the	Carrier and the second
No.	1 U	1 P	2 U	2 P
Machine where used	1, 1A, 1D, 1AD, 2, 2A Univ.	1, 1B, 1D, 1BD, 2, 2B Plain.	2A Hvy., 3, 3A, Universal.	2 Hvy., 2B Hvy., 3, 3B Pln.
Price.	\$	\$	\$	\$
No.	3 U	3 P	4 U	4 P
Machine. where used	3A Hvy. 4A Univ.	3B Hvy. 4B Plain.	4A Hvy. Universal.	4B Hvy. Plain.
Price.	\$	\$	\$	\$

A wooden box is furnished to hold the attachment and

This attachment, with extra gears, can also be used to cut Metric racks with English screw.

No. 10 CAM CUTTING ATTACHMENT.

For use on Nos. 1, 1A, 1D, 1AD, 2, 2A, 2A Heavy, 3 and 3A Universal, and Nos. 1, 1B, 1Y, 1D, 1BD, 2, 2Y, 2B, 2 Heavy, 2B Heavy, 3 and 3B Plain Milling Machines.



When ordering, give size and construction number of machine,

The Cam Cutting Attachment is used for cutting the race in either face or peripheral cams from a flat former cut from a disk. The necessary longitudinal and rotative movements are contained in the attachment, allowing the table of the machine to remain clamped in one position during the cutting of the cams.

Cams 12" in diameter, with any throw to 5", can be mounted. The former is made from a flat disk about 1-2" thick and can be easily machined to the form required. It is secured to the face of the worm wheel on the spindle which carries the blank to be cut. When provided with power feed, a three-step cone pulley, taking a round belt, is mounted on the end of the worm shaft and driven from a small jackshaft which is belted from the main counter-shaft. The pulley is clutched to the worm, so that either hand or power feed can be employed by the simple movement of a lever.

The power feed can be attached to all cam cutting attachments of previous design made by us, with only slight changes in the attachment.

Weights. Net, about 500 lbs. Ready for shipment, about 650 lbs. Dimensions for shipment, 42" x 32" x 21". Space occupied, about 16 cubic feet.

Price, \$

Price, with Power Feed, \$



This Spiral Milling Attachment is designed for the heavy class of spiral cutting. It is clamped securely to the overhanging arm and face of the column.

The Spindle is hardened, ground, and runs in phosphor bronze boxes having means of compensation for wear. It can be set at any angle in a horizontal plane, the position being indicated by graduations reading to half degrees. An outer bearing is provided for the spindle, being easily removed when placing a cutter in position. A gauge is furnished to enable the cutter to be set central with the swiveling point. The cutter is adjusted by means of a screw having a graduated dial which reads to thousandths of an inch. Hardened steel spur and bevel gears are used to drive the cutter spindle.

Attachmnt.	Machine where used,	Commencg with Mach. No.	Diameter of Spindle.	Centre of Swivel to face of Column.	Centre of Mch. Spdl. to centre of Att. Spdl.	Speeds per Minute.	Net Weight 1bs.	Price.
1	1 Universal 1A Univ. 1D Univ. 2 Universal 2A Univ. 1 Plain 1B Plain 1D Plain 1BD Plain 2 Plain 2 Plain	$\begin{array}{c} 2191\\ 2191\\ 539\\ 539\\ 1505\\ 1505\\ 684\\ 684\\ 3\\ 3\\ 1063*\\ 1063* \end{array}$	1"	11 1-8″	3 3-8″	$\begin{array}{r} 47-341\\ 45-470\\ 17-350\\ 17-414\\ 17-350\\ 17-414\\ 47-341\\ 45-470\\ 17-350\\ 17-414\\ 17-350\\ 17-414\end{array}$	155	\$
2	3 Universal 3A Univ. 2B Hvy. Pln. 3 Plain 3B Plain 3A Hvy. Un.	$\begin{array}{r} 650 \\ 650 \\ 1513 \\ 549 \\ 549 \\ 525 \\ 710 \end{array}$	1	11 5-8	-3 3-8	$\begin{array}{c} 14-483\\ 19-429\\ 19-429\\ 14-483\\ 19-429\end{array}$	175	\$
3	4A Univ. 3B Hvy. Pln. 4B Plain 4A Hvy. Un. 4B Hvy. Pln.	$ \begin{array}{r} 710 \\ 424 \\ 479 \\ 635 \\ 384 \end{array} $	11-4 11-4	15 15 7-16	2 5-8 2 5-8	27-116 29-109	350 375	} \$ \$

*Except Nos. 1098 to 1108 inclusive.

A spiral head is required when used with Plain Machines.

TILTING TABLE FOR TAPER MILLING.

For Use on Milling Machines.



The Tilting Table is designed to use in the milling of flutes in taper reamers, taps, etc. With it any ordinary index centres may be used.

Table. The table is heavy and is bolted firmly to the milling machine table. When set at the desired angle it is securely clamped by bolts at both ends. An adjusting screw is provided to aid in accurate setting.

No. of table		No. 1	No. 2
Working surface of table .		29"x 6"	43" x 9 1-4"
Width of machine table tongu	е.	5-8" & 3-4"	5.8" & 3.4"
Width of slot in table of attachm	ient	5-8"	5-8"
Greatest taper per foot in diam	eter	1 1-4"	1 1-2"
Height of table when level .		2 1-2"	3 1-4"
Net weight		100 lbs.	250 lbs.
Gross weight		125 lbs.	315 lbs.
Dimensions of box for shipmen	t.	36"x 9"x 6"	53"x 14"x 9"
Space occupied		1 1-2 cu. ft.	4 cu. ft.

Price

No. 2 SHORT LEAD ATTACHMENT.

For Nos. 1, 1A, 1D, 1AD, 2 and 2A Universal Milling Machines.



When ordering, give size and construction number of machine.

This Spiral Attachment is new in design, and can be used advantageously when it is desired to cut short leads.

It consists of a small diameter grooved pulley, mounted on an expansion bushing, a shaft support fitting on the overhanging arm of the machine and a casting clamping over the dovetail on the regular spiral head. This casting carries a swivelling gear plate and a short shaft to which a large grooved pulley is connected by a telescopic shaft and universal joints. A large gear fitting on the regular spiral head in place of the usual index plate and having 18 index holes, is also furnished, together with a change gear plate.

holes, is also furnished, together with a change gear plate. The grooved pulley on the expansion bushing is mounted in the rear end of the machine spindle. The shaft support is clamped in position on the overhanging arm of the machine in the rear of the column and the bearing of the large grooved pulley is mounted in the outer end. Power is transmitted from the pulley on the machine spindle to this large pulley by a round belt either crossed or open, thence through the telescopic shaft and universal joints to the short shaft in the casting on the spiral head.

The work is rotated from the spindle, independently of the feed screw, the latter being disconnected from the power feed mechanism. The regular index change gears furnished with the machine are used on the swivelling gear plate to connect with the large index gear to give the work the proper speed of rotation. A positive clutch, operated by a lever on the attachment, is provided for instantly stopping the rotation of the work. The required lead is obtained by gearing from the worm shaft of the spiral head to the table feed screw in the proper ratio, using the regular index change gears, allowing the rotation of the work to drive the screw for the lead. Eighteen holes in the large index gear allow indexing when cutting multiple threads. For single threads the spiral head spindle may be geared to the table feed shaft, this being practicable only when no indexing is required.

Weights. Net, about 65 lbs.; ready for shipment, about 90 lbs. Dimensions for shipment, 26" x 13" x 11". Space occupied, about 2 cubic feet.

Price. F.o.b. Providence, R. I. \$

SCALE AND VERNIER FOR MILLING MACHINES.

For Longitudinal, Transverse and Vertical Adjustments of Table.

ENGLISH OR METRIC. In ordering, give construction number of machine.



For use in connection with Milling Machines, when it is desired to make very fine adjustments of the table; as, for example, in boring jigs and work of a similar character.

SCALE AND VERNIER FOR MILLING MACHINES.

For Longitudinal, Transverse and Vertical Adjustments of Table. ENGLISH OR METRIC.

ENGLISH OR METRIC.

In ordering, give construction number of machine.

The Scale and Vernier are for use in connection with Milling Machines, when it is desired to make very fine adjustments of the table; as, for example, in boring jigs and work of a similar character.

The Longitudinal and Vertical Scales are 24" long, and graduated to 40ths of an inch. The Transverse Scale is 14" long, and is graduated to 40ths of an inch. The Vernier reads to thousandths of an inch.

No. 1 LONGITUDINAL SCALE fits the Nos. 1, 1A, 1D, 1AD, 2, 2A, 3 and 3A Universal Milling Machines. No. 2 fits the Nos. 3A Heavy, 4A and 4A Heavy Universal; Nos. 1, 1B, 1D, 1BD, 2, 2B, 2 Heavy, 2B Heavy, 3, 3B, 3B Heavy, 4B, 4B Heavy and 5B Heavy Plain, and the Nos. 1, 2 and 3 Vertical Spindle Milling Machines.

No. 1 TRANSVERSE SCALE fits the Nos. 1, 1A, 1D, 1AD, 2 and 2A Universal; Nos. 1, 1B, 1D, 1BD, 2, 2B Plain, and the No. 1 Vertical Spindle Milling Machines. No. 1 1-2 fits the Nos. 3 and 3A Universal Milling Machines. No. 2 fits the Nos. 3A Heavy, 4A, 4A Heavy Universal, and the No. 3 Vertical Spindle Milling Machines. No. 3 fits the Nos. 2 Heavy, 2B Heavy, 3, 3B, 3B Heavy, 4B, 4B Heavy and 5B Heavy Plain, and the No. 2 Vertical Spindle Milling Machines.

VERTICAL SCALE fits all machines.

Price each, \$

When it is desired to have any or all of these Scales and Verniers attached to machine at our works, price will be given on application.

Metric Scales and Vernier reading to 1-50 m/m furnished when desired.

Nos. 18, 20 and 26 in. CIRCULAR MILLING ATTACHMENTS.

Power Feed.



When ordering, give size and construction number of machine.

These Attachments are serviceable in milling circles, segments of circles, circular slots, etc., on plain and irregular shaped pieces. The 26 inch Attachment is of heavier design than either of the others, and will be found useful on the large machines for heavy work.

The Table of each attachment is heavy, has a wide bearing surface, and can be rigidly clamped in position from the side of the base. The circumference is graduated to degrees. A dial on the worm shaft of the 26 inch Attachment is graduated to read to 4 minutes.

The Feed of the table is automatic in either direction, and the table remains locked in position when the feed is automatically released. The feed is taken from the machine table feed shaft, which is reversible.

The Worm can be quickly disengaged from the wheel and the table turned by hand when setting work. Provision is made to compensate for wear of the worm and wheel.

The Base has a pan cast around it to catch oil, which is then delivered to the milling machine table. On the 26 inch Attachment a pan for oil is also cast around the table.

18" CIRCULAR MILLING ATTACHMENT.

107

No.	Machine where used.	Commeg with Mch. No.	Diam. of Table.	Height	Width of T Slots	Net Weght about	Gross Weght about	Price
10	*1 Universal 1A Univ. †1D Univ. 1AD Univ. 2 Universal 2A Univ.	2466 2516 1391 1491 3080 3030	18"	5 1-2"	5-8″	380	475	\$
1P	1 Plain 1B Plain 1D Plain 1BD Plain 2 Plain 2B Plain 1 Vert, Spd.	$1184 \\ 1235 \\ 604 \\ 554 \\ 2228 \\ 2278 \\ 554 \\ 554$	} 18	5 1-2	5-8	380	475	\$

*Except Nos. 2469, 2473, 2477, 2479, 2481, 2482, 2483, 2484 and 2485. †Except No. 1394.

Dimensions for shipment, 31"x 27"x 9" and 24"x 13"x 14".

20" CIRCULAR MILLING ATTACHMENT. POWER FEED.

No.	Machine where used.	Comm cg with Mch. No.	Diam. of Table.	Height	Width of T Slots	Net Weght about	Gross Weght about	Price
2U {	3 Universal 3A Univ.	1000 1020	20"	511"	3-4"	440	545	\$
2P {	3 Plain 3B Plain 2 Vert Sud	924 941 414	20	$5\frac{11}{16}$	3-4	440	545	\$
3U }	3A HvyUnv. 4A Univ.	1125 770	20	516	3-4	445	555	\$
3P {	3B Hvy.Pln. 4B Plain 3 Vert. Spd.	949 589 82	20	511	3-4	445	555	\$
4P	4B Hvy. Pln.	564	20	511	3-4	445	555	\$
5P	5B Hvy.Pln.	341	20	511	3-4	450	560	\$
5V	5 Vert. Spd.	113	20	$511 \\ 16$	3-4	435	535	\$

Dimensions for shipment, 35" x 27" x 9" and 28" x 16" x 15".

26" CIRCULAR MILLING ATTACHMENT. POWER FEED.

No.	Machine where used,	Commeg with Mch. No.	Diam. of Table.	Height	Width of T Slots	Net Weght about	Gross Weght about	Price
3P {	3B Hvy.Pln. 4B Plain 3 Vert. Spd.	949 589 82	26"	7 3-4"	3-4"	970	1175	\$
4P 5P	4B Hvy.Pln. 5B Hvy.Pln.	564 341	26 26	7 3-4 7 3-4	3-4 3-4	970 980	$ 1175 \\ 1180 $	\$ \$

Dimensions for shipment, 49"x 32"x 15" and 26"x 17"x 13". All of the above attachments have reversible tongues that fit T slots either 5-8" or 3-4" wide.



This Attachment is found well adapted for use upon Milling Machines, in connection with the Vertical Spindle Milling Attachment and the Slotting Attachment.

The Table is 10" in diameter and has 2 T slots, 5-8" wide. It can be rigidly clamped in position. The circumference is graduated to degrees. The index finger is adjustable. It has an oil rim around the base.

The Dial on the worm shaft is graduated to read to 5 minutes.

The Feed of table is operated by a hand wheel.

The Worm can be thrown out of mesh and the table easily turned by hand.

Reversible Tongues and Bolts fit a T slot either 5-8" or 3-4" wide.

The Attachment is 4 1-4" high.

Weights. Net, about 60 lbs.; ready for shipment, about 75 lbs. Dimensions for shipment, $18'' \ge 16'' \ge 7''$. Space occupied, about 1 cubic foot

Price, \$

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This Attachment is found well adapted for use upon Milling Machines in connection with the Vertical Spindle Milling Attachments.

The Table is 18" in diameter, and has four T slots, 5-8" wide. It can be rigidly clamped into position. The circumference is graduated to degrees. The index finger is adjustable. It has an oil pan around the base.

The Feed of table is operated by a hand wheel.

The Worm can be thrown out of mesh and the table easily turned by hand.

Reversible Tongues and Bolts fit a T slot either 5-8'' or 3-4'' wide.

The attachment is 4 7-8" high.

Weights. Net, about 235 lbs.; ready for shipment, about 280 lbs. Dimensions for shipment, 27"x 24"x 8". Space occupied, about 3 cubic feet.

> Hole in Frindle, No. Danger, Spindle apred. Net Wright, summischastoly 58 (ba. Price, \$

Price, \$

110 No. 1 HORIZONTAL MILLING ATTACHMENT For No. 1 Vertical Spindle Milling Mach. When ordering, give size and construction number of machine.



This Horizontal Milling Attachment is new in design and readily adapts the No. 1 Vertical Spindle Milling Machine for such work as cutting spiral gears, racks, milling key seats, etc. It is rigidly fastened to the spindle head of the machine.

The Spindle is driven

through bevel gears by a vertical shaft inserted in the main spindle of the machine, and can be set at any angle in a horizontal plane. The position is indicated by graduations reading to degrees. The bearings are of bronze and the front spindle bearing is provided with means of compensa-tion for wear. A drawing-in bolt is furnished for holding collets, etc., in the spindle.

It may be used on machines commencing with No. 184. Hole in Spindle, No. 7 taper; takes a "J" collet. Spindle speeds, 106 to 1333 r.p.m.

Net Weight, about 45 lbs. Price, \$

No. 1V HIGH SPEED MILLING ATTACHM'T For No. 1 Vertical Spindle Milling Machine.

When ordering, give size and construction number of machine.

This High Speed Milling Attachment is new in design and readily adapts the No. 1 Vertical Spindle Milling Machine for the lighter class of dic-sinking and other work where a very high speed is required. It is rigidly clamped to the left hand side of the machine spindle head.

The Spindle is hardened and ground and runs in a phosphor bronze bearing. The front end has a taper hole. The spindle is driven from main spindle of machine by a spur gear meshing in a pinion mounted on the attachment spindle. It may be used on machines commencing with No. 184.

Hole in Spindle, No. 4 taper. Spindle speeds, 234 to 2930 r.p.m.

Net Weight, approximately 25 lbs. Price, \$

No. 2V HIGH SPEED MILLING ATTACHM'T

For No. 2 Vertical Spindle Milling Machine.

This Attachment is similar in design to the No. 1V High Speed Milling Attachment, with the following exceptions: It is constructed considerably heavier to meet the requirements of a heavier class of work.

Hole in Spindle, No. 9 taper. Spindle speeds, 43 to 996 r.p.m. Net Weight, approximately 38 lbs. Price, \$

16" GEAR CUTTING ATTACHMENT.

111

Patented September 5, 1905; April 30, 1907.



This Attachment is used to cut gears or wheels larger and heavier than can be cut with the usual fixtures belonging to a Milling Machine.

It is exceptionally rigid in construction and designed to withstand the most severe service to which a tool of this character should be subjected.

The Centres swing 16" in diameter.

The Spindle is large in diameter; the front end is provided with a No. 11 taper hole and is threaded to receive a face plate or other fixture for holding work. A straight hole, 1 1-4" in diameter, extends from the bottom of the taper hole entirely through the spindle. The spindle can be rigidly clamped in position.

An adjustable rest, placed on the head stock, is provided as a support for the gear while being cut.

The Worm Wheel is 14 1-8" in diameter and requires 60 revolutions of the worm for one complete revolution. The worm and worm wheel can be disengaged and a handle at the back provides for turning the spindle by hand for setting or testing work. The worm and worm wheel are accurately cut and covered to protect them from dust or injury.

The Index Plates divide all numbers to 100, all even numbers to 134 and all numbers divisible by 4 to 200.

Index Sector. Index crank adjustable. Sector arms graduated.

The Tongues are reversible and fit T slots either 5-8" or 3-4" wide.

Combined Length of head and foot-stock, 22 3-4".

Weights. Net, about 180 lbs.; ready for shipment, about 250 lbs. Dimensions for shipment, 26" x 20" x 22". Space occupied, about 7 cubic feet.

Equipment. Index plates and tables explaining the use of same, wrenches and everything else shown in cut.

Price, \$

4 3-4 in. INDEX CENTRES.

For Use on No. 2 Surface and Nos. 12 and 13 Universal and Tool Grinding Machines.

The Index Plate has 24 holes, can be turned by a worm or by hand. The centres swing 4 3-4" in diameter. Combined Length, 8 1-2". Weights. Net, about 12 lbs.; ready for ship-ment, about 18 lbs. Dimensions for shipment, 11" x 9" x 7". Space occupied, about 1 cubic foot.

Price, for use on No. 2 Surface and No. 12 Universal and Tool Grinding Machine, \$. Price, for use on No. 13 Universal and Tool Grinding Machine, \$



For use when rapid indexing is done as in cutting teeth in sprocket wheels, etc. Swing respectively 8" and 12" in diam.
Spindles. Threaded, 8"-2 1-4" diameter, 4 1-2, R.H.; 12"
-2 3-4" diameter, 4, R.H. No. 11 taper holes.
Index Plate. 24 holes. Provided with hardened bushings.

Locked by hardened steel taper pin, operated by lever. Combined Length. 8 inch, 19 1-4"; 12 inch, 21 3-8". Reversible Tongues and Bolts fit a T slot 5-8" or 3-4" wide. Weights. 8"-net, 70 lbs.; ready for shipment, about 100 lbs.; 12"-net, 130 lbs.; ready for shipment, 170 lbs. Dimen-sions for shipment, 8"-22" x 12" x 11"; 12"-25" x 13" x 14". Space occupied about 2 cubic feet; about 3 cubic feet.

Equipment. Index plate and tables explaining the use of same, wrenches and everything else shown in cut.

Prices. 8", \$: 12", \$

SPECIAL INDEX PLATES.

8" Centres. Plates with four holes or less, \$5 00 each. For each additional hole up to 22 inclusive, 25c. extra. Special 23 to 32 hole plates, \$9 50 each. Capacity of plate, 32 holes. 12" Centres. Plates of four holes or less, \$8 00. For each additional hole, 25c. extra. Capacity of plate, 32 holes. For List of Tables, see page 120.

113 10 in. PLAIN INDEX CENTRES.

Patented Sept. 5, 1905; April 30, 1907.



The Centres swing 10 1-4" in diameter.

The Spindle is threaded on front end, 2 1-4" diameter, 4 1-2, R.H., and has a No.10 taper hole. The straight hole at end of taper is 1 1-16" in diameter.

The Worm Wheel is 6 1-2" in diameter, and one revolution is made by 40 revolutions of index crank. It has 24 holes and when the worm is disengaged direct indexing can be done and the wheel held by means of an index pin.

The Index Plates are the same as used on the Nos. 1, 1D and 2 Universal Milling Machines.

Index Crank and Sector. Index crank is adjustable circumferentially. Sector arms graduated.

The Head-stock can be clamped at right angle to table. Reversible Tongues and Bolts fit a T slot either 5-8" or 3-4" wide.

Combined Length of head and foot-stocks, 13 3-4". Equipment. Index plates and tables explaining the use of same, wrenches and everything else shown in cut.

Weights. Net, about 50 lbs.; ready for shipment, about 80 lbs. Dimensions for shipment, 19"x 13"x 12". Space occupied, about 2 cubic feet.

Price, \$

12 in. PLAIN INDEX CENTRES.

Patented Sept. 5, 1905; April 30, 1907.

These Centres are of the same general design as the 10" Index Centres described above.

The Spindle is threaded on one end, 2 1-4" diameter, 4 1-2, R.H., and has No. 10 taper hole.

The Centres swing 121.4" in diameter. The Worm Wheel is 7 3.4" in diameter.

Reversible Tongues and Bolts fit a T slot either 5-8" or 3-4" wide.

Combined Length of head and foot stocks, 16 3-4".

Equipment. Index plates and tables explaining the use of same, wrenches and everything else shown in cut of 10" Index Centres.

Weights. Net, about 70 lbs.; ready for shipment, about 100 lbs. Dimensions for shipment, 21"x 14"x 13". Space occupied, about 2 cubic feet.

Price, \$ For List of Tables, see page 120.
No. 2 1-2 TRIPLE INDEX CENTRES.

114

For Direct Indexing Only.



These Index Centres are convenient for use on Milling or other machines. They are well adapted for grooving taps and reamers, milling nuts, cutting small gears and other work of a similar character.

The Centres swing, using the three spindles 2 1-2", using the two outside spindles 5". The spindles are operated simultaneously by the movement of the index crank and clamped at one time by means of a thumb screw on front of headstock. The front ends are provided with No. 9 taper holes.

The Index Plate furnished divides all numbers as follows: 2, 3, 4, 5, 6, 7, 8, 10, 12, 14, 20 and 24.

The Foot-stock is provided with adjustable centres that can be clamped.

Combined Length of head and foot-stock, 13 1-2".

The Tongues are reversible and fit T slots either 1-2" or 5-8" wide.

Weights. Net, about 80 lbs.; ready for shipment, about 95 lbs. Dimensions for shipment, 22" x 12 " x 10". Space occupied, about 2 cubic feet.

Equipment. Everything shown in cut.

Price. F.o.b. Providence, R. I. \$

No. 14 TRIPLE INDEX CENTRES. Patented September 5, 1905; April 30, 1907.

The Centres swing using the three spindles, 4": using the two outside spindles, 8".

The Spindles are operated simultaneously by the move-ment of the index crank. The front ends are provided with No. 10 taper holes; the straight hole at end of taper is 1 1-16" in diameter. The lever shown at one side of the head clamps all three spindles at once.

The Index Plates divide all numbers to 50, and all even numbers to 100, except 96. The index table furnished gives all divisions obtainable to 380. A plate containing 24 holes for rapid indexing of work is placed directly on the centre spindle, and when rapid or plain indexing is desired, the worm, which turns the spindle, is thrown quickly out of gear by means of a knob on the side of the head-stock.

Sector. Sector arms graduated.

The Foot-stock is provided with adjustable centres. Combined Length of head and foot-stock, 21 1-2". The Tongues and Bolts furnished are reversible and fit a T slot 5-8" or 3-4" wide.

Weights. Net, about 190 lbs.; ready for shipment, about 250 lbs. Dimensions for shipment, 24" x 20" x 15". Space occupied, about 4 cubic feet.

Equipment. Three index plates and tables explaining the use of same, wrenches, and everything else shown in cut. Price. F.o.b. Providence, R. I. \$

No. 4 TRIPLE INDEX CENTRES. For Direct Indexing Only.

These Centres are of the same capacity and general design as the No. 14, but they are equipped for Direct Indexing only.

Equipment. Wrenches, etc. Price. F.o.b. Providence, R. I. \$

SPECIAL INDEX PLATES. For No. 4 Triple Index Centres.

Plates with four holes or less, \$5.00 each. For each ad-ditional hole up to 22 inclusive, 25c. extra. Special 23 to 32 hole plates, \$9 50 each. Capacity of plate, 32 holes.

911 No. 14 TRIPLE INDEX GENTRES

6 inch UNIVERSAL INDEX CENTRES.

Patented September 5, 1905; April 30, 1907.



These Index Centres are entirely new and designed for the lighter class of milling. The total length of the centres is made as short as practicable to permit the maximum length of work when used on short tables.

The Centres swing 6" in diameter.

The Head can be set at any angle from 5 degrees below the horizontal to 15 degrees beyond the perpendicular. The graduations on the side of the head are engine divided and read to degrees.

The Spindle has a No. 9 taper hole. The straight hole at end of taper is 7.8" in diameter. The front end is threaded 1 3.4" diameter, 5 thds-U.S.S.; R. H., to receive a chuck or other fixture.

The Foot-stock Centre is adjustable.

Combined Length of head and foot-stock, 12".

The Index Plates furnished divide all numbers to 50 and all even numbers to 100 except 96. The index table furnished gives all divisions obtainable to 380. A plate containing 24 holes, for rapid indexing of work, is placed directly on the spindle, and when rapid or plain indexing is desired, the worm, which turns the spindle, is thrown quickly out of gear.

Index Crank and Sector. Index Crank is adjustable circumferentially. Sector arms graduated.

The Tongues and Bolts fit a T slot 5-8" wide.

Weights. Net, about 34 lbs. Ready for shipment, about 50 lbs. Dimensions for shipment, $16'' \ge 10'' \ge 10''$.

Equipment. Wrenches, index plates and table explaining the use of same.

Price. F.o.b. Providence, R. I., \$

\$

A 4"3-jawed Universal Chuck, with 2 sets of jaws for holding work by the outside to the full diameter of chuck body and for holding rings when finished on the outside, furnished when ordered.

Price of Chuck, including Plate for attaching to Spindle,

12 in. 14 in. and 15 in. UNIVERSAL INDEX CENTRES. 10 inch

UNIVERSAL INDEX CENTRES.

Patented Sept. 5, 1905; April 30, 1907.



The Centres swing 10" in diameter.

The Head can be set at any angle from 10 degrees below the horizontal to 30 degrees beyond the perpendicular.

The Spindle has a No. 10 taper hole. The straight hole at end of taper is 1 1-16" in diameter. The front end is threaded, 2 14" diameter, 4 1-2, R.H.

The Foot-stock Centre can be raised vertically and set at an angle in a vertical plane.

Combined Length of head and foot-stock, 17".

The Index Plates divide all numbers to 50 and all even numbers to 100 except 96. The index table furnished gives all divisions obtainable to 380. A plate containing 24 holes, for rapid indexing of work, is placed directly on the centre spindle and when rapid or plain indexing is desired, the worm, which turns the spindle, is thrown quickly out of gear by means of a knob on the side of the head-stock.

Index Crank and Sector. Index Crank is adjustable circumferentially. Sector arms graduated.

Tongues and Bolts fit a T slot 5-8" wide.

Weights. Net, about 90 lbs.; ready for shipment, about 105 lbs. Dimensions for shipment, 18"x 13"x 12". Space occupied, about 1 cubic foot.

Equipment. Index plates and table explaining the use of same and everything else shown in cut.

Price, S	
6" 3-jaw Chuck, \$	extra.
For List of Tables,	see page 120.

118

12 in., 14 in. and 15 in. UNIVERSAL INDEX CENTRES

These centres are the same in design as the 10 inch Universal Index Centres with the exception of the following details.

12 inch Universal Index Centres.

The Centres swing 12" in diameter. For our machines these centres fit: Nos. 2 Heavy, 2B Heavy, 3 and 3B Plain, and No. 2 Vertical Spindle.

The Head can be set at any angle from 10 degrees below the horizontal to 5 degrees beyond the perpendicular. The Spindle has a No. 11 taper hole. The straight hole at

end of taper is 11-4" in diameter. The front end is threaded 21-2" diameter, 4 R.H., to receive a chuck or other fixture.

Combined Length of head and foot-stock, 19".

Tongues and Bolts fit a T slot 5-8" wide.

Weights. Net, about 140 lbs. Ready for shipment, about 205 lbs. Dimensions for shipment, 21" x 18" x 16",

Equipment. Index plates and table explaining the use of same and wrenches.

Prices. F.o.b. Providence, R. I. \$ With S' 3-jawed For List of Tables, see page 120, Universal Chuck, \$

14 inch Universal Index Centres.

The Centres swing 14" in diameter. For our machines these centres fit. Nos. 3B Heavy and 4B Plain, and No. 3 Vertical Spindle.

The Head can be set at any angle from 10 degrees below the horizontal to 5 degrees beyond the perpendicular.

The Spindle has a No. 11 taper hole. The straight hole at end of taper is 11.4" in diameter. The front end is threaded 2 3.4" diameter, 4 R.H., to receive a chuck or other fixture. Combined Length of head and foot-stock, 21 1-4". Tongues and Bolts fit a T slot 3.4" wide.

Weights. Net, about 210 lbs. Ready for shipment, about 300 lbs. Dimensions for shipment, 24" x 20" x 16". Equipment. Index plates and table explaining the use of

same and wrenches.

Prices. F.o.b. Providence, R. I. \$ With 9" 3-jawed Universal Chuck, \$ For List of Tables, see page 120.

15 inch Universal Index Centres.

The Centres swing 15" in diameter. For our machines these centres fit: Nos. 4B Heavy, and 5B Heavy Plain.

The Head can be set at any angle from 10 degrees below

the horizontal to 5 degrees beyond the perpendicular. The Spindle has a No. 12 taper hole. The straight hole at end of taper is 11-2" in diameter. The front end is threaded 2 3-4" diameter, 4 R.H., to receive a chuck or other fixture.

Combined Length of head and foot-stock, 21 1-4".

Tongues and Bolts fit a T slot 3-4" wide. Weights. Net, about 225 lbs. Ready for shipment, about 320 lbs. Dimensions for shipment, 24" x 20" x 16".

Equipment. Index plates and table explaining the use of same and wrenches.

Prices. F.o.b. Providence, R. I. \$ With 9" 3-jawed For List of Tables, see page 120. **Universal Chuck**, \$

12 1-2 Inch UNIVERSAL INDEX CENTRES.

119

Patented Sept. 5, 1905; April 30, 1907.



The Centres swing 12 1-2" in diameter.

The Head can be set at any angle from 10 degrees below the horizontal to 10 degrees beyond the perpendicular.

The Spindle is provided with a face plate and adjustable dog carrier. The front end has a No. 12 taper hole. The straight hole at end of taper is 1 1-2" in diameter.

The Worm Wheel is 6" in diameter, and one revolution is made by 60 revolutions of index crank.

The Foot-stock Centre can be raised vertically and set at an angle in a vertical plane.

Index Sector. Sector arms graduated.

The Index Plates divide all numbers to 100, all even numbers to 134. The index table furnished gives all divisions obtainable to 380.

Combined Length of head and foot-stock. 18".

Centre Rest will take work to 3 1-8" in diameter. Tongues Reversible. Fit a T slot 5-8" and 3-4" wide.

Weights. Net, about 160 lbs; ready for shipment, about 205 lbs. Dimensions for shipment. 23"x 16"x 15". Space occupied about 3 cubic feet.

Equipment. Index plates and tables explaining the use of the same, wrenches and everything else shown in cut.

Price, \$

For List of Tables, see page 120.

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These Tables are provided with flanges and oil pans and channels.

Jentres, used.	Lengt'i Over All.	Width Over All.	Working Surface.	Width of T Slot.	Combined Length of Head and Foot Stock.	Weight,	Price
T	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1						
al	37 3-4"	7 3-4"	30 3-4"x 5 1-4"	5-8"	19 1-4"	110 lbs.	60
10	37 3-4	7 3-4	30 3-4 x 5 1.4	5-8	14 3-4	», 011	
	37 3-4	7 3-4	30 3-4 x 5 1-4	5-8	17	i10 "	
100	37 3-4	7 3-4	30 3-4 X 5 1-4	5-8	19 1-8	110 "	
ial	39 1-4	8 3-4	32 X 6	3-4	20 1-4	140 "	
.30	39 1-4	8 3-4	32 X 6	3-4	17 3-4	140 "	25
ersal	39 1-4	8.34	32 X 6 .	3-4	18	140 "	E
I	42 1-4	8.34	35 X 6	3-4	22 5-8	152 "	VI
d zz	42 1-4	8 3-4	35 x 6	3-4	22 5=8	152 "	

120



These Vises are provided with flanges for clamping them to the table of Milling or Planing Machines. Furnished with bolts, nuts, washers and clamp.

Size.	Price.	Width of Jaws.	Depth of Jaws.	Jaws Open.	Weight.
No.1.F No.2-F No.3-F No.4-F No.5-F	$\$15 00 \\ 17 00 \\ 26 00 \\ 38 00 \\ 53 00$	4 1-8" 5 1-8 6 1-8 7 1-8 8 5-8	$ \begin{array}{r} 1 \ 1 \cdot 16'' \\ 1 \ 1 \cdot 4 \\ 1 \ 9 \cdot 16 \\ 2 \\ 2 \ 1 \cdot 2 \\ \end{array} $	$\begin{array}{r} 2''\\ 2 & 3.4\\ 3 & 5.8\\ 4 & 1.2\\ 7\end{array}$	18 lbs. 29 " 51 " 96 " 182 "

Jaws, of steel, hardened unless otherwise specified.



The vise is clamped to the base by either one of the two clamping bolts.

The vises are furnished with tongues as follows: No. 2-S, 5-8"; Nos. 3-S and 4-S, reversible for either 5-8" or 3-4" slots and can be used on any table fitted with corresponding T slots. They are also furnished with bolts, nuts and washers.

Size.	Price.	Width of Jaws.	Depth of Jaws.	Jaws Open.	Height.	Weight.
No. 2-S	\$20 00	5 1-8"	1 1-4"	2 3-4"	4 1-2"	45 lbs.
" 3-S	28 00	6 1-8	1 9-16	3 5-8	5 3-16	70 "
" 4-S	40 00	7 1-8	2	4 1-2	6 3-8	110 "

Jaws of hardened steel unless otherwise specified.

ADJUSTABLE SWIVEL VISE.



This Vise can be set at any angle with the T slots of the table and is pivoted so that it can be set at any angle to 40 degrees either side of the horizontal. Bolts, nuts, washers and clamp are furnished. Height of vise, 4".

The jaws are 5" wide, 1" deep, and will open 2 3-4". Weights. Net, about 30 lbs.; ready for shipment, about 40 lbs. Dimensions for shipment, 13" x 12" x 6".

Price, \$22 00.

TOOL MAKERS UNIVERSAL VISES.

123



No.	Width of Jaws.	Depth of Jaws.	Jaws Open.	Net Weight.	Shipping Weight.	Price.
2-T	5 1-8"	$ \begin{array}{c} 1 \ 1-4'' \\ 1 \ 9-16 \end{array} $	2 3-4"	65 lbs.	80 lbs.	\$50 00
3-T	6 1-8		3 5-8	135 lbs.	160 lbs.	65 00

The base is double. The lower part is provided with a reversible tongue which can be used in a 5-8" or 3-4" T slot and is fastened to the table by two bolts, which fit into the table T slots. It has two sets of slots to allow for moving the vise back when set in a vertical plane. The upper part is a hinged knee, which swivels on the lower part of the base. The lower part of the knee is graduated and can be set at any angle in a horizontal plane. The upper part of the knee is hinged to the lower part in such a manner that it can be set at any angle to 90° in a vertical plane and clamped rigidly in position by the nut on end of bolt forming the hinge and the bracing levers shown at left of cut. The upper surface is graduated for setting the vise proper. The bolt forming the hinge is provided with a hardened steel dial graduated to 90°. The bracing levers are held in position by the bolt shown in centre and the reversible tongue which can be used in a 5-8" or 3-4" T slot are held in position by the bolt shown in centre and the bolts at the ends of the levers.

The vise proper swivels on the upper part of the hinged knee, can be set at any angle to the axis of the bolt forming the hinge and clamped in position by the bolt which holds the upper bracing lever.

The jaws are made of tool steel, hardened. Each vise is furnished with suitable wrenches.

Dimensions of boxes is which vises are shipped: No. 2-T, 17" x 12" x 9"; No. 3-T, 21" x 14" x 11.

No.

10 in. x 24 in.

UNIVERSAL GRINDING MACHINE.

Patented June 30, 1903; Feb. 18, 1908; Feb. 23, 1915.



Capacity:

CENTRES SWING 10" IN DIAMETER-OVER WATER GUARDS, 8 1-2". CENTRES TAKE 24" IN LENGTH.

No. 1 10 in. x 24 in. UNIVERSAL GRINDING MACHINE.

125

- Wheel Spindle. Of tool steel. Hardened, ground and lapped. Phosphor bronze boxes provided with means of compensation for wear; self-aligning. Takes wheels to 10" diameter, 3-8" to 1-2" thick.
- Wheel Stand Slide. Graduated to degrees. Wheel can be used in any position without interference. Transverse movement controlled by hand wheel. Dial graduated to thousandths of an inch on diameter of work. Metal cover provided.
- Automatic Cross Feed. Accurate. Range .00025" to .004" at each reversal of table. Easily and quickly set. Automatically thrown out when work is to size.
- Swivel Table. Turns on a large central stud, hardened and ground. Clamped at both ends. Scale reads to 7°, 3" taper per foot, and 25%.
- Table. Controlled by adjustable dogs; dog brackets slide on rack. Oil distributed evenly by rolls. Ways protected by metal covers. T slot, 9-16" wide. Controlling levers at front.
- Speeds and Feeds. Speeds of wheel and work, and feed of table entirely independent of each other. Two changes of spindle speed, 2684 and 3560 r.p.m. Eight changes of work speed from 75 to 670 r.p.m. Eight changes of table feed from 3" to 50" per minute for any work speed. One lever on front of machine starts and stops speed of head-stock and feed of table independent of motive power.
- Reversing Mechanism. Accurate. Allows work to be ground close to shoulder.
- Head-stock. Swivels. Spindle hardened, ground and lapped. Front end threaded, 1 1-2" diameter, 6 R.H., U.S.S. Has No. 6 taper hole. Can be locked for grinding on dead centres. Bronze boxes provided with means of compensation for wear.
- Foot-stock. Clamped by lever. Metal cover protects spindle. Holder for carbon point attached. Wheel can be trued without removing work.
- Universal Back Rests. For supporting slender work or splined shafts. Universal in all movements. Capable of delicate adjustments.
- Wet Grinding. Provision for abundant supply of water. Pump simple in construction.
- Base. Rigidly braced. Supported on three points.
- Counter-shaft. Tight and loose pulleys, 8" diameter. 3" belt. Speed: 290 revolutions per minute.
- Floor Space. Parallel to spindle, 92"; at right angles, 40".
 Weights. Net, about 2375 lbs.; ready for shipment, about 2890 lbs. Dimensions for shipment, 72" x 36" x 48". Space occupied, about 72 cubic feet.
- Equipment. No. 03 internal grinding fixture, 6" 4-jawed chuck, large face plate, plain back rest, 2 universal back rests, centre rest; 2 grinding wheels: 1, 6" diameter, 1-2" thick, 2" hole, and 1, 10" diameter, 1-2" thick, 3" hole; set of dogs, set of telescopic water guards, wrenches and everything else shown in cut, together with overhead works.
- Price. F.o.b. Providence, R. I. \$

For Attachments, see pages 158 to 165.

UNIVERSAL GRINDING MACHINE.

12 in. x 30 in.

No. 2

Patented June 30, 1903; Feb. 18, 1908; Feb. 23, 1915.

Capacity:

CENTRES SWING 12" IN DIAMETER-OVER WATER GUARDS 10 3-4".

CENTRES TAKE 30" IN LENGTH.

No. 2 12 in. x 30 in. UNIVERSAL GRINDING MACHINE.

- Wheel Spindle. Of tool steel. Hardened, ground and lapped. Phosphor bronze boxes provided with means of compensation for wear; self-aligning. Takes wheels to 12" diameter, 1-2" to 1" thick.
- Wheel Stand Slide. Graduated to degrees. Wheel can be used in any position without interference. Transverse movement controlled by hand wheel. Dial graduated to thousandths of an inch on diameter of work. Metal cover provided.
- Automatic Cross Feed. Accurate. Range .00025" to .004" at each reversal of table. Integral part of machine, easily and quickly set. Automatically thrown out when work is to size. Swivel Table. Turns on large central stud, hardened and
- ground. Clamped at both ends. Scale reads to 8°, 3 1-2" taper per foot, and 30%.
- Table. Controlled by adjustable dogs; dog brackets slide on rack. Oil distributed evenly by rolls. Ways protected by
- metal covers. T slot, 34" wide. Controlling levers at front. Speeds and Feeds. Speeds of wheel and work and feed of table entirely independent of each other. 4 changes of wheel speed varying from 1521 to 2939 revolutions per minute. 12 changes of work speed varying from 39 to 644 revolutions per minute. 10 changes of table feed varying from 1 1.2" to 50" per minute available for any work speed. One lever on front of machine starts and stops speed of head-stock and feed of table independent of motive power.
- Reversing Mechanism. Accurate. Allows work to be ground close to shoulder.
- Head-stock. Swivels. Spindle hardened, ground and lapped. Front end threaded, 2" diameter, 4 1-2 R.H., U.S.S. Has No. 9 taper hole. Can be locked for grinding on dead centres. Bronze boxes provided with means of compensation for wear.
- Foot-stock. Clamped by lever. Metal cover protects spindle. Holder for carbon point attached. Wheel can be trued without removing work.
- Universal Back Rests. For supporting slender work. Universal in all movements. Capable of delicate adjustments.
- Wet Grinding. Provision for abundant supply of water. Pump simple in construction.
- Base. Rigidly braced. Supported on three points.
- Counter-shaft. Tight and loose pulleys, 12" diameter. 31-2" belt. Speed: 310 revolutions per minute.
- Floor Space. Parallel to spindle, 124"; at right angles, 50". Weights. Net, about 4050 lbs.; ready for shipment, about 4700 lbs. Dimensions for shipment, 78"x 49"x 48". Space occupied, about 106 cubic feet.
- Equipment. No. 4 internal grinding fixture, 8" 4-jawed chuck, large face plate, plain back rest, 2 universal back rests, 4 adjustable shoes, centre rest; 2 grinding wheels: 1 offset, 12" diameter, 1 3-8" thick, 3" hole; 1, 12" diameter, 1" thick, 5" hole; set of dogs, set of telescopic water guards, wrenches and everything shown in cut, together with overhead works.

Price. F.o.b. Providence, R. I. \$

For Attachments, see pages 158 to 165.



Capacity: CENTRES SWING 12" IN DIAMETER-OVER WATER GUARDS, 10 3-4". CENTRES TAKE 40" IN LENGTH.

No. 3 12 in. x 40 in.

UNIVERSAL GRINDING MACHINE.

- Wheel Spindle. Of tool steel. Hardened, ground and lapped. Phosphor bronze boxes provided with means of compensation for wear; self-aligning. Takes wheels to 12" in diameter, 1-2" to 1" thick.
- Wheel Stand Slide. Graduated to degrees. Wheel can be used in any position without interference. Transverse movement controlled by hand wheel. Dial graduated to thousandths of an inch on diameter of work. Metal cover provided.
- Automatic Cross Feed. Accurate. Range .00025" to .004" at each reversal of table. Integral part of machine, easily and quickly set. Automatically thrown out when work is to size.
- Swivel Table. Turns on large central stud, hardened and ground. Clamped at both ends. Scale reads to 8°, 3 1-2" taper per foot, and 25%.
- Table. Controlled by adjustable dogs; dog brackets slide on rack. Oil distributed evenly by rolls. Ways protected by metal covers. T slot, 3-4" wide. Controlling levers at front.
- Speeds and Feeds. Speeds of wheel and work and feed of table entirely independent of each other. 4 changes of spin-dle speed varying from 1521 to 2939 revolutions per minute. 12 changes of work speed varying from 39 to 644 revolutions per minute. 10 changes of table feed varying from 1 1-2" to 50" per minute in two series, available for any work speed. One lever on front of machine starts and stops speed of head-stock and feed of table independent of motive power.
 Reversing Mechanism. Accurate. Allows work to be ground close to shoulder.
- Head-stock. Swivels. Spindle hardened, ground and lapped; front end threaded, 2" diameter, 4 1-2, R.H., U.S.S. Has No. 9 taper hole. Can be locked for grinding on dead centres. Bronze boxes provided with means of compensation for wear.
- Foot-stock. Clamped by lever. Metal cover protects spindle. Holder for carbon point attached. Wheel can be trued without removing work.
- Universal Back Rests. For supporting slender work. Universal in all movements. Capable of delicate adjustments.
- Wet Grinding. Provision for abundant supply of water. Pump simple in construction.

Base. Rigidly braced. Supported on three points.

Counter-shaft. Tight and loose pulleys, 12" diameter. 3 1-2" belt. Speed: 310 revolutions per minute.

Floor Space. Parallel to spindle, 154"; at right angles, 52".

Weights. Net, about 4550 lbs.; ready for shipment, about 5300 lbs. Dimensions for shipment, 86"x 48"x 48". Space occupied, about 115 cubic feet.

- Equipment. No.4 internal grinding fixture, 8" 4-jawed chuck, large face plate, plain back rest, 2 universal back rests, centre rest; 2 grinding wheels: 1 offset, 12" diameter, 1 3-8" thick, 3" hole; 1, 12" diameter, 1" thick, 5" hole; set of dogs, set of telescopic water guards, wrenches and everything else shown in cut, together with overhead works.
- Price. F.o.b. Providence, R. I. \$

For Attachments, see pages 158 to 165.



No. 4 12 in. x 60 in. UNIVERSAL GRINDING MACHINE.

- Wheel Spindle. Of tool steel. Hardened, ground and lapped. Phosphor bronze boxes provided with means of compensation for wear; self-aligning. Takes wheels to 12" diameter, 1-2" to 1" thick.
- Wheel Stand Slide. Graduated to degrees. Wheel can be used in any position without interference. Transverse movement controlled by hand wheel. Dial graduated to thousandths of an inch on diameter of work. Metal cover provided.
- Automatic Cross Feed. Accurate. Range .00025" to .004" at each reversal of table. Integral part of machine, easily and quickly set. Automatically thrown out when work is to size.
- Swivel Table. Turns on large central stud, hardened and ground. Clamped at both ends. Scale reads to 6°, 2 1-2" taper per foot, and 20%.
- Table. Controlled by adjustable dogs; dog brackets slide on rack. Oil distributed evenly by rolls. Ways protected by metal covers. T slot, 3-4" wide. Controlling levers at front.
- Speeds and Feeds. Speeds of wheel and work, and feed of table entirely independent of each other. Four changes of spindle speed varying from 1521 to 2939 revolutions per minute. Twelve changes of work speed varying from 39 to 644 revolutions per minute. Ten changes of table feed varying from 1 1-2" to 50" per minute available for any work speed. One lever on front of machine starts and stops speed of headstock and feed of table independent of motive power. Reversing Mechanism. Allows work to be ground close to

shoulder.

Head-stock. Swivels. Spindle hardened, ground and lapped. Front end threaded, 2" diameter, 4 1-2, R.H., U.S.S. Has No. 9 taper hole. Can be locked for grinding on dead centres. Bronze boxes provided with means of compensation for wear.

Foot-stock. Clamped by lever. Metal cover protects spindle. Holder for carbon point attached. Wheel can be trued without removing work.

Universal Back Rests. For supporting slender work. Universal in all movements. Capable of delicate adjustments.

Wet Grinding. Provision for abundant supply of water. Pump simple in construction.

Base. Rigidly braced. Supported on three points.

Counter-shaft. Tight and loose pulleys, 12" diameter. 31-2" belt. Speed: 310 revolutions per minute.

Floor Space. Parallel to spindle, 207"; at right angles, 52".

Weights. Net, about 5725 lbs.: ready for shipment, about 6650 lbs. Dimensions for shipment, 120"x 46"x 50". Space occupied, about 160 cubic feet.

Equipment. No. 4 internal grinding fixture, 8" 4-jawed chuck, large face plate, plain back rest, 2 universal back rests, centre rest; 2 grinding wheels: 1 offset, 12" diameter, 1 3-8" thick, 3" hole; 1, 12" diameter, 1" thick, 5" hole; set of dogs, set of telescopic water guards, wrenches and everything else shown in cut, together with overhead works.

Price. F.o.b. Providence, R. I. \$

For Attachments, see pages 158 to 165.



Capacity:

CENTRES SWING 6" IN DIAMETER. CENTRES TAKE 20" IN LENGTH.

No. 10 6 in. x 20 in. PLAIN GRINDING MACHINE.

Drive. Single pulley 10" diameter, 2" belt, runs at constant speed of 900 r.p.m. Ball bearings on drive shaft.

Wheel Spindle. Of tool steel. Hardened, ground and lapped. Phosphor bronze boxes, provided with means of compensation for wear; self-aligning. Whee; on end of spindle, can be easily removed. Takes wheels to 12" diam., 1" to 1 1-2" thick. Wheel Slide. Transverse movement controlled by hand wheel. Dial is graduated to thousandths of an inch on diameter of

work. Provision is made for quick movement.

Automatic Cross-feed. Accurate. Range .00025" to .004" at each reversal of table. Integral part of machine easily and quickly set. Automatically thrown out when work is to size. Independent automatic cross feed also provided. Feeds wheel toward work without traversing table, for grinding surfaces narrower than wheel. 12 changes for each work speed. Lock prevents traversing table while using this feed.

- speed. Lock prevents traversing table while using this feed.
 Swivel Table. Turns on large central stud, hardened and ground. Clamped at both ends. Can be set at angle to table ways. Scale reads to 9°, 31.2" taper per foot and 30%.
 Table. Traverse controlled by adjustable dogs; dog brackets slide on rack. Oil distributed evenly by rolls. Ways protected by metal covers. Controlling levers at front.
 Speeds and Feeds. Speeds of wheel and work, and feed of table on the product of even other.
- table entirely independent of each other. 4 changes of spindle speed by split spindle pulleys varying from 1525 to 2850 revolutions per minute. 12 indicated changes of work speed varying from 140 to 720 revolutions per minute. 24 indicated changes of table feed in 2 series; slow series 13" to 69", fast series 36" to 181" per minute. Instantaneous speed and feed changes by levers on front of bed operating multiple friction disk speed case on rear. One lever on front starts and stops work.
- Reversing Mechanism. Accurate. Allows work to be ground close to shoulder. Table stopped at reversing point by move-

ment of lever at any time during table travel. Head-stock. Clamped by lever. Spindle stationary. Foot-stock. Clamped by lever. Holder for carbon point attached. Wheel can be trued without removing work.

Universal Back Rests. Universal in all movements. Capable of most delicate adjustments.

Wet Grinding. Tank cast in bed of machine. Pump simple in construction; needs no priming or packing.

Counter-shaft. Tight and loose pulleys 10" diameter. 3" belt.

Speed: 450 revolutions per minute.
Floor Space. Parallel to spindle, 88"; at right angles, 49".
Weights. Net, about 3700 lbs. Ready for shipment, about 4200 lbs. Dimensions of box for shipment, 61" x 54" x 59". Space occupied, 112 cubic feet.

Equipment. Plain back rest, 2 universal back rests, set of dogs, centre grinding attachment, 2 grinding wheels: one 12" diameter, 1" thick, 5" hole, one 12" diameter, 1 1-2" thick, 5" hole; wrenches and everything else shown in cut together with overhead works.

Price. F.o.b. Providence, R. I. \$ For Attachments, see pages 158 to 165.

No. 11

6 in. x 32 in.

134

PLAIN GRINDING MACHINE.

Patented June 30, 1903; Aug. 15, 1905; Feb. 20, 1906; Jan. 28, Feb. 18, 1908; Feb. 23, 1915.



Capacity:

CENTRES SWING 6" IN DIAMETER. CENTRES TAKE 32" IN LENGTH. GAL OF A LOW TO THE REAL PROPERTY AND A STORE

No. 11 6 in. x 32 in. PLAIN GRINDING MACHINE.

Drive. Single pulley 10" diameter, 3" belt. Runs at constant speed of 900 r.p.m. Roller bearings on drive shaft. Wheel Spindle. Of tool steel. Hardened, ground and lapped.

Phosphor bronze boxes provided with means of compensa-tion for wear; self-aligning. Wheelon end of spindle, can be easily removed. Takes wheels to 14" diameter, 1" to 2" thick.

Wheel Slide. Transverse movement controlled by hand wheel. Dial is graduated to thousandths of an inch on diameter of work. Provision is made for quick movement.

Automatic Cross Feed. Accurate. Range .00025" to .004" at each reversal of table. Integral part of machine, easily and quickly set. Automatically thrown out when work is to size. Independent automatic cross feed also provided. Feeds wheel toward work without traversing table, for grinding surfaces narrower than wheel. 12 changes for each work speed. Lock prevents traversing table while using this feed.

- Swivel Table. Turns on large central stud, hardened and ground. Clamped at both ends. Can be set at angle to table
- ways. Scale reads to 7°, 3" taper per foot, and 25%. Table. Controlled by adjustable dogs; dog brackets slide on rack. Oil distributed evenly by rolls. Ways protected by metal covers. Controlling levers at front. Speeds and Feeds. Speeds of wheel and work, and feed of
- table entirely independent of each other. 4 changes of spindle speed by split spindle pulleys varying from 1340 to 2300 revolutions per minute. 12 indicated changes of work speed varying from 80 to 400 revolutions per minute. 24 indicated changes of table feed in two series; slow series 13" to 69", fast series 36" to 181" per minute. Instantaneous speed and feed changes by levers on front of bed operating multiple friction disk speed case on rear. One lever on front starts and stops work

Reversing Mechanism. Accurate. Allows work to be ground close to shoulder. Table stopped at reversing point by movement of lever at any time during table travel. Head-stock. Clamped by lever. Spindle stationary. Foot-stock. Clamped by lever. Holder for carbon point attached. Wheel can be trued without removing work.

Universal Back Rests. Universal in all movements. Capable of most delicate adjustments.

Wet Grinding. Tank cast in bed of machine. Pump simple in construction; needs no priming or packing.

Counter-shaft. Tight and loose pulleys, 12" diameter. 3 1-2" belt. Speed: 450 revolutions per minute.

Floor Space. Parallel to spindle, 122"; at right angles, 50".

- Weights. Net, about 4150 lbs.; ready for shipment, about 4700lbs. Dimensions of box for shipment, 68" x 54" x 58". Space occupied, 123 cubic feet.
- Equipment. Plain back rest, 3 universal back rests, set of dogs, centre grinding attachment, 2 grinding wheels, 1, 14" diameter, 1" thick, 5" hole; 1, 14" diameter, 2" thick, 5" hole; wrenches and everything else shown in cut, together with overhead works.

Price. F.o.b. Providence, R. I. \$

For Attachments, see pages 158 to 165.



No. 12 8 in. x 36 in. PLAIN GRINDING MACHINE.

- Wheel Spindle. Of tool steel. Hardened, ground and lapped. Phosphor bronze boxes provided with means of compensation for wear; self-aligning. Wheel on end of spindle. Takes wheels to 18" diameter, 1 1-2" to 2" thick.
- **Wheel Slide.** Transverse movement controlled by hand wheel; provided with quick adjustment. Dial graduated to read to thousandths of an inch on diameter of work.
- Automatic Cross Feed. Accurate. Range .00025" to .004" at each reversal of table. Integral part of machine; easily and quickly set. Automatically thrown out when work is to size. Independent automatic cross feed also provided. Feeds wheel toward work without traversing table, for grinding surfaces narrower than wheel. 6 changes for each work speed. Lock prevents traversing table while using this feed.
- Swivel Table. Turns on large central stud, hardened and ground. Clamped at both ends. Scale reads to 8°, 3 1-2" taper per foot, and 30%.
- Table. Controlled by adjustable dogs; dog brackets slide on rack. Oil distributed evenly by rolls. Ways protected by metal covers. Controlling levers at front.
- Speeds and Feeds. Speeds of wheel and work, and feed of table entirely independent of each other. 4 changes of spindle speed varying from 1000 to 1700 revolutions perminute. 12 changes of work speed obtained by hardened gears, varying from 53 to 309 revolutions per minute. 12 changes of table feed obtained by hardened gears, varying from 12" to 108" per minute, available for any work speed. Changes made by adjustment of index slide and levers. One lever on front of machine starts and stops speed of head-stock and feed of table independent of motive power.
- Reversing Mechanism. Accurate. Allows work to be ground close to shoulder. Table stopped at reversing point by movement of lever at rear of hand wheel at any time during table travel. Table hand wheel disconnected during operation of automatic feed.

- Head-stock. Clamped by lever. Spindle stationary. Foct-stock. Clamped by lever. Metal cover protects spindle. Holder for carbon point attached. Wheel can be trued without removing work.
- Universal Back Rests. For supporting slender work. Universalin all movements. Capable of delicate adjustments.

Wet Grinding. Provision for abundant supply of water. Pump simple in construction. Tank and pump in bed.

Counter-shaft. Tight and loose pulleys, 14" diameter. 5" belt. Speed: 450 revolutions per minute.

Floor Space. Parallel to spindle, 146"; at right angles, 55". Weights. Net, about 6350 lbs.; ready for shipment, approximate, 7200 lbs. Dimensions for shipment, about 88" x 58" x 55". Space occupied, about 163 cubic feet.

Equipment. 1 plain back rest, 3 universal back rests, 6 adjustable bronze shoes, centre rest, centre grinding attachment, set of water guards, set of dogs, 2 grinding wheels: 1, 18" diameter, 1 1-2" thick, 5" hole; 1, 18" diameter, 2" thick, 5" hole; wrenches and everything shown in cut, together with overhead works.

Price. F.o.b. Providence, R.I. \$

For Attachments, see pages 158 to 165.



Capacity: CENTRES SWING 10" IN DIAMETER. CENTRES TAKE 48" IN LENGTH.

No. 14 10 in. x 48 in. PLAIN GRINDING MACHINE.

- Wheel Spindle. Of tool steel. Hardened, ground and lapped. Phosphor bronze boxes, provided with means of compensation for wear; self-aligning. Takes wheels to 20" diameter, 2" to 3" thick.
- Wheel Slide. Transverse movement controlled by hand wheel. Dial graduated to thousandths of an inch on diameter of work. Provision is made for quick adjustment.
- Automatic Cross Feed. Accurate. Range .00025" to .004" at each reversal of table. Integral part of machine. Easily and quickly set. Automatically thrown out when work is to size. Independent automatic cross feed also provided. Feeds wheel toward work without traversing table, for grinding surfaces narrower than wheel. 6 changes for each work speed. Lock prevents traversing table while using this feed.
- Swivel Table. Turns on large central stud, hardened and ground. Scale reads to 7°, 3" taper per foot, and 25 %. Clamped at both ends.
- Table. Controlled by adjustable dogs; dog brackets slide on rack. Oil distributed evenly by rolls. Controlling levers at front.
- Speeds and Feeds. Speeds of wheel and work and feed of table entirely independent of each other. 4 changes of spindle speed varying from 1000 to 1700 revolutions per minute. 12 changes of work speed obtained by hardened gears varying from 50 to 292 revolutions per minute, in two series. 12 changes of table feed obtained by hardened gears varying from 14" to 126" per minute, in two series; available for any work speed. Changes made by adjustment of index slide and levers. One lever on front of machine starts and stops work speed and table feed independent of motive power.
- Reversing Mechanism. Accurate. Allows work to be ground close to shoulder. Table stopped at reversing point by movement of lever at rear of hand wheel at any time during traverse. Table hand wheel disconnected during operation of power feed.

Head-stock. Clamped by lever. Spindle stationary.

- Foot-stock. Clamped by lever. Metal cover protects spindle, Holder for carbon point attached. Wheel can be trued without removing work.
- Combination Plain and Universal Back Rests. For supporting slender work or splined shafts. Universal in all movements. Capable of most delicate adjustments. Provide solid support for heavy grinding.
- Wet Grinding. Provision for abundant supply of water. Pump simple in construction; needs no priming or packing. Tank and pump inside bed of machine.
- Counter-shaft. Tight and loose pulleys, 18" diameter. 6" belt. Speed: 450 revolutions per minute.

Floor Space. Parallel to spindle, 167"; at right angles 56".

Weights. Net, about 8300 lbs. Ready for shipment, about 9400 lbs. Dimensions of boxes for shipment, 103"x 57"x 56" and 117"x 9"x 9". Space occupied, about 191 cubic feet and 6 cubic feet respectively,

Equipment. 4 combination plain and universal back rests, 4 adjustable shoes, centre rest, centre grinding attachment, water guards, set of dogs; 2 grinding wheels: 1, 20"diameter, 2" thick, 5" hole; 1, 20" diameter, 3" thick, 5" hole, wrenches and everything shown in cut, together with overhead works. Price. F.o.b. Providence, R. I. \$



Capacity: CENTRES SWING 10" IN DIAMETER. CENTRES TAKE 72" IN LENGTH.

141 No. 16 10 in. x 72 in. PLAIN GRINDING MACHINE.

- Wheel Spindle. Of tool steel. Hardened, ground and lapped. Phosphor bronze boxes provided with means of compensation for wear; self-aligning. Wheel on end of spindle. Takes wheels to 20" diameter, 2" to 3" thick.
- Wheel Slide. Transverse movement controlled by hand wheel: provided with quick adjustment. Dial graduated to thousandths of an inch on diameter of work.
- Automatic Cross Feed. Accurate. Range .00025" to .004" at each reversal of table. Integral part of machine, easily and quickly set. Automatically thrown out when work is to size. Independent automatic cross feed also provided. Feeds wheel toward work without traversing table, for grinding surfaces narrower than wheel. 6 changes for each work
- speed. Lock prevents traversing table while using this feed. Swivel Table. Turns on large central stud, hardened and ground. Clamped at both ends. Scale reads to 6°, 2 1-2" taper per foot, and 20%.
- Table. Controlled by adjustable dogs; dog brackets slide on rack. Oil distributed evenly by rolls. Ways protected by metal covers. Controlling levers at front.
- Speeds and Feeds. Speeds of wheel and work, and feed of table entirely independent of each other. 4 changes of spindle speed varying from 1000 to 1700 revolutions per minute. 12 changes of work speed obtained by hardened gears varying from 50 to 292 revolutions per minute. 12 changes of table feed obtained by hardened gears varying from 14" to 126" per minute, available for any work speed. Changes made by adjustment of index slide and levers. One lever on front of machine starts and stops speed of head-stock and feed of table independent of motive power.
- Reversing Mechanism. Accurate. Allows work to be ground close to shoulder. Table stopped at reversing point by movement of lever at rear of hand wheel at any time during table travel. Table hand wheel disconnected during operation of automatic feed.

- Head-stock. Clamped by lever. Spindle stationary. Foot-stock. Clamped by lever. Metal cover protects spindle. Holder for carbon point attached. Wheel can be trued without removing work.
- Combination Plain and Universal Back Rests. For supporting slender work. Universal in all movements. Capable of delicate adjustments. Provides solid support for heavy work. Wet Grinding. Provision for abundant supply of water.
- Pump simple in construction; needs no priming or packing. Pump and tank enclosed in bed of machine.
- Counter-shaft. Tight and loose pulleys, 18" diameter. 5" belt. Speed: 450 revolutions per minute.
- Floor Space. Parallel to spindle, 220"; at right angles, 56". Weights. Net, about 8500 lbs. Ready for shipment, about 9800 lbs. Dimensions for shipment, 115" x 59" x 56" and 141"x 9"x 9". Space occupied, about 220 and 7 cubic feet. Equipment. 5 combination plain and universal back rests,
- 5 adjustable shoes, centre rest, centre grinding attachment, set of water guards, set of dogs, 2 grinding wheels: 1, 20" diameter, 2" thick, 5" hole; 1, 20" diameter, 3" thick, 5" hole; and everything shown in cut, with overhead works.

Price. F.o.b. Providence, R. I. \$

For Attachments, see pages 158 to 165.

No. 2 18 in. x 6 in. x 9 1-2 in.

142

SURFACE GRINDING MACHINE.



Capacity:

LONGITUDINAL FEED, 18" AUTOMATIC. TRANSVERSE FEED, 6" VERTICAL ADJUSTMENT, 9 1-2".

No. 2

18 in. x 6 in. x 9 1-2 in. SURFACE GRINDING MACHINE.

The Spindle is hardened, ground and lapped and runs in phosphor bronze boxes provided with means of compensation for wear. The end is tapered to receive wheel sleeves. It can be raised or lowered by means of a hand wheel graduated to read to one-half thousandths of an inch. It will take wheels to 7" in diameter and 1-2" thick.

The Table is $46'' \log$ and 8'' wide, has a working surface $18'' \ge 6''$ and $3 \ge 12''$ wide.

The Travel of Table is automatic in either direction and is controlled by means of dogs operating against a reversing lever. The lever can be turned down and the table moved beyond the reversing points without changing the dogs.

The Transverse Movement of table is automatic, feeds at the end of each stroke and can be easily changed to feed in either direction.

Automatic Cross Feed Stop provided for throwing out feed at any desired point.

This Machine grinds work to 18" long, 6" wide and 9 1-2" high.

The Vise is flanged and has jaws 4 1-8" long, 1 1-16" deep, and will open 2".

The Counter-shaft has tight and loose pulleys 8" in diameter for 3" belt and should run 315 revolutions per minute.

Floor Space, 65" x 30".

Weights. Net, about 1200 lbs.; ready for shipment, about 1500 lbs. Dimensions for shipment, $40'' \ge 35'' \ge 70''$. Space occupied, about 57 cubic feet.

Equipment. No. 1F Flanged Vise, 1 grinding wheel, 7" diameter, 1-2" thick, 1 1-4" hole; diamond tool holder bracket, wrenches and overhead works.

Price. F.o.b. Providence, R. I. \$

For Adjustable Swivel Vise and Index Centres, see pages 111 to 119 and 122.

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SELECTION OF GRINDING WHEELS.

COARSENESS OR FINENESS OF WHEELS. Wheels are numbered from coarse to fine; that is, a wheel made of No. 60 grain is coarser than one made of No. 100. Within certain limits, and other things being equal, a coarse wheel is less liable to change the temperature of the work, or glaze, than a fine wheel. As a rule, the harder the stock the coarser the wheel required to produce a given finish. For example, coarser wheels are required to produce a given surface upon hardened steel than upon soft steel, while finer wheels are required to produce the same surface upon brass or copper than upon either hardened or soft steel.

SOFTNESS OR HARDNESS OF WHEELS. Wheels are made in a number of grades in order to meet a great variety of conditions without the necessity of changing the wheel speed for every condition. Wheels for soft steel are harder than for hardened steel or cast iron. For brass, copper and rubber they are much softer. The temper of a wheel is dependent upon the quality of the abrasive particles to withstand dulling, so that the better the material the better the temper.

Wheels are graded from soft to hard, and the grade is denoted by the letters of the alphabet, "A" usually denoting the softest grade. A wheel is soft or hard according to the amount and character of other material combined in the process of manufacture with emery, corundum or other abrasive; but, other characteristics being equal, a wheel that is composed of fine grain is more compact and harder than one made of coarser grain. For instance, a wheel of No. 100 grain, grade B, will be harder than one of No. 60 grain, same grade.

A soft wheel is less apt to change the temperature of the work, or to become glazed, than a harder one. It is best for grinding hardened steel, cast iron, brass, copper and rubber, while a harder and more compact wheel is better for grinding soft steel and wroughtiron. As a rule, the harder the stock the softer the wheel required to produce a given result.

Booklet, "Points About Grinding Wheels and Their Selection," furnished free on request. No. 0 TOOL GRINDING MACHINE.



This machine is especially adapted for grinding the small form cutters and tools used on screw machines.

The Spindle is hardened and ground and runs in phosphor bronze boxes provided with means of compensation for wear. The ends of the spindle are tapered to receive the wheel sleeves. Speed: 2800 revolutions per minute. It will take wheels to 7" diameter, 1 2" thick and 3.4" hole. It has tight and loose pulleys, 2 1.2" in diameter for 1" belt.

Distance from centre of spindle to bottom of base, 8 1-2". Weights. Net, about 50 lbs.; ready for shipment, about 65 lbs. Dimensions for shipment, 16" x 12" x 12". Space occupied, about 2 cubic feet.

Equipment. Two grinding wheels: 1, 7" dia., 3-8" thick, 3-4" hole; 1 bevel and concave, 6" dia., 1-2" thick, 3-4" hole; two wheel sleeves, 1 1-4", and wrenches.

Price. F.o.b. Providence, R. I. \$

Price, mounted on column, \$

OVERHEAD WORKS.

The Overhead Works, furnished only when specified, consist of either 2 wall or 2 ceiling hangers and shaft with 1 pulley 6" diameter, for 2" belt, for main line drive; and 1 pulley 12" diameter for driving the machine spindle. The counter-shaft should run about 585 revolutions per minute.

Weights. Net, about 85 lbs.; ready for shipment, about 100 lbs. Price. \$

The Spindle is of steel, hardened and ground, and runs in phosphor bronze boxes provided with means of compensation for wear. The ends of the spindle are tapered to receive wheel sleeves. Speed, 2800 revolutions per minute.

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No. 1 TOOL GRINDING MACHINE.

The Counter-shaft has one pair of tight and loose pulleys 6" in diameter for 2" belt and should run about 500 revolutions per minute.

Weights. Net, about 315 lbs; ready for shipment, about 425 lbs. Dimensions for shipment, 49" x 19" x 18". Space occupied, about 10 cubic feet.

Floor Space. Right angles to spindle 16". Parallel to spindle 18".

Equipment, Two grinding wheels: 1, 7" diameter, 1-2" thick, 1 1-4" hole, and 1 bevel and concave, 6" diameter, 1-2" thick, 1 1-4" hole; two wheel sleeves, 1 1-4", and wrench, together with overhead works.

Price. F.o.b Providence, R. I. \$

No. 2 CUTTER GRINDING MACHINE.

147



This machine will take cutters to 6" length and 6" diameter and saws to 24" diameter.

The Spindle is hardened, ground and lapped and runs in phosphor bronze boxes provided with means of compensation for wear. Ends of spindle tapered to receive wheel sleeves.

The Cone has 2 steps for 1" belt.

The Cutter Bar, steel, hardened and ground.

The Cutter Bar, steel, hardened and ground. The Counter-Shaft, tight and loose pulleys 6" in diameter for 2" belt. Speed, about 420 revolutions per minute. Floor Space, 27" x 34". Weights. Net, about 430 lbs.; ready for shipment, about 600 lbs. Dimensions for shipment, 35" x 28" x 51". Space occupied, about 29 cubic feet.

Equipment. Compound swivel head, rest holder, 3-4" cutter bar, 7-8" cutter shell with collars and nuts, arbor for holding straddle and face mills, etc. 2 taper shank mill bushings, 2, 1 1-4" wheel sleeves; 1 pair step collars, 1 1-2", 1 3-4", 2"; 3 grinding wheels, 2 bevel and concave, 6" diameter, 1-2" thick, 1 1-4" hole; 1, 6" diameter, 1-4" thick, 1 1-4" hole, and everything shown in cut, together with overhead works. Price. F.o.b. Providence, R. I. \$

For Form Cutter Grinding Attachment, see page 160.

No. 3 UNIVERSAL CUTTER AND REAMER

148 DATE OVICE 148 DATE TO THE

GRINDING MACHINE.



Capacity:

TAKES 18" BETWEEN CENTRES. CUTTERS AND SHELL REAMERS TO 6" DIAMETER AND 7" LENGTH.

No. 3 UNIVERSAL CUTTER AND REAMER GRINDING MACHINE.

This machine is used for sharpening straight and taper, shell or shank reamers, and for grinding edge and bevel cutters of any angle, straddle and face mills, cotter and hollow mills and straight or taper milling cutters, cut either straight or spiral, with holes or shanks. It can also be used for sharpening worm and thread tools.

Capacity. The machine takes 18" between centres and grinds cutters and shell reamers to 6" in diameter and 7" in length.

The Spindle is of steel, hardened, ground and lapped, and runs in bronze boxes provided with means of compensation for wear. The ends of the spindle are tapered to receive wheel sleeves.

The Cone has 2 steps for 1" belt.

The Guide Bar and cutter bars are of steel, hardened, ground and lapped.

The Counter-shaft has tight and loose pulleys 6" in diameter for 2" belt, and should run about 375 revolutions per minute.

Floor Space, 33" x 58".

Weights. Net, about 500 lbs.; ready for shipment, about 760 lbs. Dimensions for shipment, 42" x 28" x 51". Space occupied, about 35 cubic feet.

Equipment. Compound swivel head, reamer centres, rest holder, 3-4" cutter bar, 3-8" cutter bar, thread and worm tool holder, 7-8" cutter shell with collars and nut, takes all cutters with 7-8", 1", 1 1-16", 1 1-8" or 1 1-4" hole; 1-2" cutter shell with collars and nut, takes all cutters with 1-2", 5-8" or 3-4" hole; 1 pair step collars, 1 1-2", 1 3-4", 2"; arbor for holding straddle and face mills, ang dar cutters, etc., takes all cutters with 1 1-4", 1" or 7-8" hole: 2 wheel sleeves, 1 1-4"; 2, 1 each Nos. 7 and 9, Taper shank mill bushings, 2 main bar stops; 3-4" swivel head bushing, 3-8" swivel head bushing; 5 grinding wheels, 2 bevel and concave, 6" diameter, 1-2" thick, 1 1-4" hole; 1, 6" diameter, 1-4" thick, 1 1-4" hole; 1, 3" diameter, 1-4"

Price. F.o.b. Providence, R. I. \$

The Form Cutter Grinding Attachment is readily attached to the machine.

Price, \$ extra.

A special pamphlet on the construction and use of this machine is sent on application.

No. 12 12 in. x 18 in. UNIVERSAL AND TOOL GRINDING MACHINE.

Patented January 28, 1908.



Capacity:

CENTRES SWING 12" IN DIAMETER. CENTRES TAKE 18" IN LENGTH.

No. 12

12 in. x 18 in. UNIVERSAL AND TOOL GRINDING MACHINE.

Capacity. Centres take 18" in length; swing 12" in diameter. Wheel Spindle. Of crucible steel, hardened, ground and lapped. Phosphor bronze boxes provided with means of compensation for wear. Driven by 2-step cone for 1" belt. Speeds: 3180 and 3970 revolutions per minute.

- Wheel Stand. Has transverse adjustment of 1 1-2". Longitudinal adjustment of spindle, 4". Radial adjustment to any angle.
- Swivel Table. Can be set to 90° either side of zero line. Can be set to 30° either side of zero line with head-stock in place. Graduated arc at front reads to degrees.
- Sliding Table. Ways proportioned to give large wearing surfaces. Operated by crank on front of saddle. Fine hand feed operated by internal gear and pinion. Transverse adjustment, 8". Vertical adjustment, 10 1-2". Hand wheels graduated to thousandths of an inch, control transverse and vertical adjustments. Longitudinal adjustment, 26".
- Work Speeds. 16 changes varying from 110 to 530 revolutions per minute. Obtained by multiple friction disks, controlled by levers on side and front of case. Provision made for stopping mechanism independent of overhead works.

Cutter Bars. Hardened, ground and lapped.

Universal Head. Takes work to 16" diameter over table; 22" in diameter at right angles to table.

- Centre Rest. Takes work to 2" diameter.
- Wet Grinding. Provision for abundant supply of water. Pump simple in construction; needs no priming or packing. Tank part of machine casting.
- Counter-shaft. Tight and loose pulleys, 6" diameter. 2" belt. Speed: 440 revolutions per minute.
- Floor Space. Parallel to spindle, 83 1-2". At right angles to spindle, 45".
- Weights. Net, about 1700 lbs. Ready for shipment, about 2035 lbs. Dimensions for shipment, about 61" x 40" x 48". Space occupied, about 68 cubic feet.
- Equipment. Universal head, face chuck, set of dogs, 3-4" cutter bar with 7-8" sliding shell and set of collars, including 4 stepped collars; 3-8" cutter bar with bushing for universal head and 1-2" sliding shell, with set of collars, including 2 stepped collars; arbor for straddle and face mills and 3 collars, 2 taper shank mill bushings; 2 tooth rests and holders; 2 centres; centre rest; diamond tool holder bracket; 2 wheel arbors—1, 1-4"; 1, 3-4"; 2 wheel sleeves, 1 1-4"; 7 grinding wheels—1, 6" diam., 1-2" thick, 1 1-4" hole; 1, 3" diam., 1-4" thick, 3-4" hole; 1, 6" diam., 1-4" thick, 1 1-4" hole; 1, 2" diam., 1-4" thick, 1-4" hole; 2 bevel and concave, 6" diam., 1-2" thick, 1 1-4" hole; 1 cupped, 4" diam., 1 3-8" thick, 1 1-4" hole; and everything else shown in cut, together with overhead works.

Price. F.o.b. Providence, R. I. \$

For Attachments, see page 154.

No. 13 UNIVERSAL AND TOOL GRINDING

152

MACHINE.

Patented March 25, 1902; Feb. 20, 1906; Feb. 23, 1915.



Capacity:

CENTRES SWING 8" IN DIAMETER. CENTRES TAKE 24 1-2" IN LENGTH. LONGITUDINAL TABLE FEED, 17", AUTOMATIC.

No. 13 UNIVERSAL AND TOOL GRINDING MACHINE.

Automatic Table Feed.

- This machine combines the features of a Universal Grinding Machine, together with such features as adapt it to the sharpening of bevel cutters of any angle, milling cutters, form cutters, straddle and face mills, straight or taper reamers, end mills etc., also for grinding all cylindrical work, either straight or taper, that can be held between centres.
- Wheel Spindle. Of crucible steel. Hardened, ground and lapped. Phosphor bronze boxes provided with means of compensation for wear. Ends tapered to receive wheel sleeves. 1 1-4" belt.
- Wheel Spindle Slide. Vertical adjustment, 6". Operated by adjustable hand wheel, graduated to thousandths of an inch.
- Spindle Slide Upright. Transverse movement, 10 1-2". Operated by hand wheel, graduated to thousandths of an inch on diameter of work. Swivels. Base graduated to 90° either side of zero line.

Cutter Bars. Hardened, ground and lapped.

- Swivel Table. Turns on central stud, hardened and ground. Can be set to 90° either side of zero line. Graduated arc at front reads to degrees. Scale at end of table reads to 3" taper per foot. Automatic table feed, 17". Centres. Swing 8" diameter. Take 24 1-2". Universal head
- swings 16" diameter.

Centre Rest. Takes work to 2" diameter. Counter-shaft. Tight and loose pulleys, 6" diameter. 2" belt. Speed: 425 revolutions per minute.

- Floor Space. At right angles to spindle, 45". Parallel to spindle, 69".
- Weights. Net, about 2250 lbs.; ready for shipment, about 2850 lbs. Dimensions for shipment, 55" x 44" x 64". Space occupied, about 89 cubic feet.
- Equipment. Universal head, face chuck, set of dogs, centre height gauge; 3-4" cutter bar with 7-8" sliding shell and set of collars, including 4 stepped collars; 3-8" cutter bar with bushing for universal head and 1-2" sliding shell, with set of collars, including 2 stepped collars; arbor for straddle and face mills and 3 collars, 2 taper shank mill bushings, 4 tooth rests and holders; 3 centres, including reamer grinding centre; centre rest; tool rest; diamond tool holder bracket; centre; centre rest; tool rest; diamond tool holder bracket; 2 wheel arbors-1, 1-4" R.H.; 1, 1-4" L.H.; 8 wheel sleeves -1, 1-2"; 1, 3-4"; 6, 1 1-4"; 10 grinding wheels--1, 1" diam., 1-4" thick, 1-4" hole; 1, 2" diam., 1-4" thick, 1-4" hole; 1, 3" diam., 1-4" thick, 3-4" hole; 1, 6" diam., 3-8" thick, 1 1-4" hole; 2, 7" diam., 1-2" thick, 1 1-4" hole; 1 bevel and concave, 3 1-2" diam., 7-16" thick, 1-2" hole; 1 bevel and concave, 6" diam., 1-2" thick, 1 1-4" hole; 1 cupped, 4" diam., 1 3-8" thick, 1 1-4" hole; 1 cupped, 7" diam., 2" thick, 1 1-4" hole; and everything else shown in cut, together with overhead works. Price. F.o.b. Providence, R. I. \$

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ATTACHMENTS

For Nos. 12 and 13 Universal and Tool Grinding

Machines.

SURFACE GRINDING ATTACHMENT.

The Surface Grinding Attachment is convenient for all varieties of surface grinding within the capacity of the machine.

For No. 12 Universal and Tool Grinding Machine.

The Vise is mounted upon a hinged base that can be set to any angle from 0 to 90° in 'a vertical plane. A dial, grad-uated to degrees, indicates the setting. 'The jaws are hard-ened, 4 1-8" wide, 1 1-16" deep and will open 2". Height of vise, 4 7-16".

The Table Plate has a working surface of 4 1-4"x 4 1-4" and is 1 1-4" thick. It has 2 T slots, 1-2" wide, at right angles. Weights: Net, about 37 lbs.; gross, about 50 lbs.

Price, Attachment complete, F.o.b. Providence, R. I. \$

For No. 13 Universal and Tool Grinding Machine.

The Vise is the same as above.

The Wheel Spindle Extension is supported in a self-aligning bearing, carried in a bracket bolted to the wheel slide. It allows the wheel to be used over the entire surface of the table plate.

The Table Plate has a working surface of 17" x 7 3-8" and is 1 3-4" thick. It has 2 T slots, 1-2" wide, at right angles.

Weights: Net, about 65 lbs.; gross, about 85 lbs. Price, Attachment complete, F.o.b. Providence, R. I. \$

INTERNAL GRINDING ATTACHMENT.

For Grinding Holes Either Straight or Taper.

This Attachment consists of a knee, clamped to the front of .he wheel slide by four bolts for the No. 13 Machine and a platen, rigidly clamped to the wheel stand base for the No. 12 Machine. The Internal Grinding Fixture shown on page 158 is mounted on the knee or platen and is driven by a belt from a pulley on the wheel spindle. No. 03 Fixture is regularly furnished with the Attachment, but Nos. 01, 02 or 04 can be substituted without extra charge. See page 158 for capacity of the four sizes.

Price includes 2 grinding wheels, 4" 3-jawed universal chuck, belt and driving pulley.

Price, complete for No. 12 Machine, F.o.b. Providence, R.I. \$ Price, complete for No.13 Machine, F.o.b. Providence, R.1. \$

4 3-4" INDEX CENTRES.

These Centres are convenient for grinding form cutters and work of a similar class.

See page 112 for description

ATTACHMENTS

FOR

No. 13 Universal and Tool Grinding Machine.

RADIAL GRINDING ATTACHMENT.

This Attachment is for grinding convex and concave cutters and work of a similar character. It is rigidly clamped to the machine table by two bolts.

The Slide swivels and has adjustable stops to control the swivel movement. It has an adjustment of 4 1-2"; also a fine adjustment for feeding the work to the cut. A cross slide is provided with means for fine adjustment. A device for receiving the carbon point holder, furnished together with the carbon point, can be quickly mounted on the inner end of the slide for truing the wheel.

The Work Holders will take 5" in length and swing 8" in diameter.

Weights: Net, about 60 lbs.; gross, about 85 lbs. Price, F.o.b. Providence, R. I. \$

HOB GRINDING ATTACHMENT.

This Attachment has been designed to accurately sharpen spirally cut hobs. By its employment, the correct lead of the grooves is maintained and the teeth are ground radially and equidistant. Hobs of practically any length and up to Sinches in diameter can be accommodated. The general design resembles the spiral head used on our Universal Milling Machines, the gearing being arranged in the same order and gears of the same numbers of teeth being employed; therefore any hob grooved on a B & S Milling Machine can be sharpened.

Two index plates providing for hobs of from 2 to 20 grooves, together with the necessary change gears and a printed table of gears and spirals, are furnished with the attachment.

Weights: Net, about 100 lbs.; gross, about 145 lbs. Price, F.o.b. Providence, R. I. \$

TOOL CUPBOARD.

A cupboard conveniently arranged for holding the various parts and attachments used on the No. 13 Universal and Tool Grinding Machine can be furnished. It is substantially made of wood and fitted with shelves, brackets, pins, etc. to accommodate the parts in as little space as practicable.

Dimensions: Height, 39"; floor space, 16"x 38".

Price, F.o.b. Providence, R. I. \$

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Nc. 23

GEAR CUTTER GRINDING

MACHINE.



TAKES CUTTERS TO 8" IN DIAMETER, 2 1-2" THICK.

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No. 23

GEAR CUTTER GRINDING MACHINE.

This Machine is designed to grind gear cutters radial, as well as many varieties of form cutters.

Capacity. Will take cutters to 8" diameter, 2 1-2" thick.

- Wheel Spindle. Of steel, hardened, ground and lapped. Runs in bronze boxes provided with means of compensation for wear. End of spindle tapered to receive grinding wheel sleeves.
- Wheel Spindle Stand. Rests on a slide dovetailed to main casting. Has transverse movement of 4", operated by a hand lever through rack and segment; longitudinal movement of 1-2" through rack and pinion to bring wheel central with work to be ground.

Drive. Cone, 2 steps. 1 1-4" belt. Speed: 2400 and 3450 revolutions per minute. Safety device provided.

- Work Spindle. 7-8" diameter. Takes cutters with holes of 7-8", 1", 11-16", 11-4", 11-2" and 13-4" diameter by means of sleeves. Has indexing mechanism that divides all numbers of teeth from 5 to 18. Has fine feed operated by hand wheel through worm and wheel.
- Wet Grinding. Provision for abundant supply of water. Pump simple in construction; needs no priming or packing. Insures large steady flow of water on cutter.
- Counter-shaft. 1 tight and 1 loose pulley, 6" diameter. 2" belt. Speed: 600 revolutions per minute.
- Floor Space. Parallel to wheel spindle, 33"; at right angles to wheel spindle, 39".
- Weights. Net, about 795 lbs.; ready for shipment, about 1065 lbs. Dimensions for shipment, 41"x 37"x 55". Space occupied, about 50 cubic feet.
- Equipment. Set of work sleeves, 1", 11-16", 11-4", 11-2" and 13-4" diameter, 7-8" hole. Set of filling in collars for same. 3 work spindle clamp washers. Wheel centre gauge. Work centre gauge. Diamond tool holder. 2 Grinding wheels, bevel and concave, 8" diameter, 3-4" thick, 1 1-4" hole. Wrenches and overhead works.

Price. F.o.b. Providence, R. I. \$

INTERNAL GRINDING FIXTURES.



These Fixtures consist of a grinding spindle of comparatively small size, mounted in an adjustable bearing, carried by telescopic tubes of sufficiently large diameter to give the required rigidity. These tubes are adjustable longitudinally, relatively to each other, to take up wear in the bearing and furnish a support for the spindle in close proximity to the grinding wheel. The small diameter of the spindle enables it to be run at the required high speeds. The pulley spindle is mounted in annular ball bearings which take the pull of the belt, eliminate friction, and increase the life of the fixture.

Provision is made for excluding dust from the bearings. One of these fixtures is sent with and included in the price of each of our Universal Grinding Machines.

Capacity of Internal Grinding Fixtures.

Distance Diameter Speed, Revolu-Length from Diameter No. of No. of Bottm of of Holes that that Fix-Machine of Hole tions Stand to can be can be in Wheel. ture. where used. per Centre of Ground. Ground. Minute. Spindle. *01 3" 1 1.2" 1-4" to 1-2" 1, 12 and 13 3-32" 16800 *1 1-4 to 1-2 2, 3 and 4 4 5-8 1 1.2 3.32 16800 02 1.12 and 13 3 3 3.4 1-2 to 7-8 1.4 13400 2, 3 and 4 4 5.8 3 3.4 1-2 to 7-8 1.4 13400 1,12 and 13 3.4 to 1 1.8 103 3 51-4 1.4 12200 3 2. 3 and 4 4 5-8 51.4 3-4 to 1 1-8 1.4 12200 04 1.12 and 13 3 5.8 11200 6 11 & upward 2, 3 and 4 4 5-8 6 13 & upward 5.8 11200 5 2. 3 and 4 2 4 5-8 8 &upward 34 8950

*The Nos. 01 and 1 fixtures differ in design from the cut and are provided with three wheels and arbors of varying lengths. †Furnished with Nos. 1, 12 and 13 Universal Grinding Machines.

‡Furnished with Nos. 2, 3 and 4 Universal Grinding Machines.

Price includes 2 grinding wheels and belt.

Price. F.o.b. Providence, R. I., fixtures Nos. 01 and 1, \$ Price. Nos. 02, 03, 04, 2, 3 and 4, \$ Special sizes made to order. UNIVERSAL HEAD. For Universal Grinding Machines.



This Attachment furnishes effective means for holding tools, milling cutters, counter-sinks, counter-bores, etc., while being ground. Work having either straight or taper shanks, or holes for mounting upon arbors or bushings, can be accommodated.

The principal feature of its construction is a swivel vertical column carrying a swivel head for supporting the work. The column is mounted on a heavy base plate and can be set at any angle to the table in a horizontal plane. The work head, in turn, can be set at any angle to 90° either side of zero in a vertical plane, and has a vertical adjustment of 4". Work up to 16" in diameter will swing over the table and, by placing the head at right angles to the table, light work up to 24" in diameter can be taken.

It is made in four styles, the difference being in the base construction and wheel furnished. One fits on the No. 1 Universal Grinding Machine; one on the Nos. 2, 3 and 4 Universal Grinding Machines; one on the No. 12 Universal and Tool Grinding Machine, and one on the No. 13 Universal and Tool Grinding Machine.

Two grinding wheels suitable for grinding cutters and tools, together with other necessary parts and tools, are furnished with the attachment.

In ordering, specify the machine the attachment is to be used on.

Weight. Net, about 62 lbs.; ready for shipment, about 91 lbs. Dimensions for shipment, 22" x 12" x 12".

Price, \$



This Attachment is used for grinding the teeth of Form Cutters radially, this being necessary in order to insure their cutting the correct form. It consists of a bed, rigidly attached to the main bar, that carries a sliding table provided with a pair of index centres between which the work to be ground is held.

Centres swing 4 3.4" in diameter and take 10 1.2" in length. The Index Plate has 24 holes and can be turned by a worm or the worm can be disengaged and the plate turned by hand. Form cutters to 8" in diameter can be ground by the use of raising blocks.

Weights. Net, about 75 lbs.; ready for shipment, about 100 lbs. Dimensions for shipment, 20" x 13" x 12". Space occupied, about 2 cubic feet.

Price, \$

Price of 2" Raising Blocks, \$

For No. 2 Cutter Grinding Machine and No. 3 Universal Cutter and Reamer Grinding Machine, see pages 147 to 149. HOLLOW MILL GRINDING ATTACHMENT. For No. 0 Tool Grinding Machine.

161



This attachment is convenient for grinding plain hollow mills such as are used on Screw Machines.

Head. The head that carries the work spindle is supported upon guide bars that are hardened and ground. It can be swiveled and rigidly clamped in position. The work spindle is fitted to receive bushings for holding the mills, and is provided with a large knurled knob for holding the spindle when work is being ground. A tooth rest holder is placed on the head to receive the tooth rest for supporting the work.
Adjustable Stop. An adjustable stop can be set to limit the movement of the head.

Capacity. Hollow mills 1" diameter can be ground and with the two bushings furnished hollow mills with shanks No.5 taper and 5.8" diameter.

Guide Rods. The guide rods are supported in a cast iron arm that fits into the tool rest bracket of the machine; the attachment can thus be quickly placed in position or removed.
Price. F.o.b. Providence, R. I. \$

UNIVERSAL BACK RESTS. For Universal and Plain Grinding Machines. Patented June 30, 1903.

162



The Back Rests are universal in all their movements and capable of the most delicate adjustment. They are simple in construction and readily placed in position or removed.

No,	Machines where used.	Price.
$1 \\ 2 \\ 11 \\ 12$	No. 1 Universal Nos. 2, 3 and 4 Universal No. 11 Plain No. 12 Plain	\$12 00 12 00 12 00 12 00 12 00

Price does not include shoes. For lists of Shoes, see pages 164, 165. Special Circular on application.

TABLE WATER GUARDS. For Universal Grinding Machines.

These can be used on all Nos. 1 and 2 Universal Grinding Machines fitted with pumps; and all Nos. 3 and 4 Universal Grinding Machines delivered since January, 1899.

PRICE PER SET.

For No.	1	Universal	Grinding	Machine,	\$5	50
For No.	2	Universal	Grinding	Machine,	\$6	00
For No.	3	Universal	Grinding	Machine,	\$7	00
For No.	4	Universal	Grinding	Machine.	88	00

No. 14 COMBINATION PLAIN AND UNIVERSAL BACK REST.

For Nos. 14 and 16 Plain Grinding Machines. Patent pending.



This Rest is for use on the Nos. 14 and 16 Plain Grinding Machines. It embodies all of the well known features of the Universal Back Rests, being capable of delicate adjustments and following up the work as it is reduced in diameter by grinding.

It can also be used as a semi-Universal Back Rest for heavy work by substituting the solid adjustable shoe beneath the work, and the spring actuated support behind the work.

For very heavy grinding, it can be used as a Plain Back Rest with a solid support both at the side of and below the work. It will take an adjustable bronze shoe No. 3-6, with capacity 1" to 2 1-2" as listed on page 165, or a solid bronze shoe, capacity up to 3 1-2" as listed on pages 164 and 165.

In addition it is supplied with three sets of special solid shoes.

A removable cover keeps out water and grit from the elevating screw and nut when it is used as a Universal Back Rest.

Price, including three sets of solid shoes, adjustable shoe and cap, \$25 00.

164

BRONZE SHOES FOR UNIVERSAL BACK RESTS.

For Nos. 1 and 11.

Pattern No.	Diameter of Work.	Price each	Pattern No.	Diameter of Work.	Price each
1 - 3	1-4"	\$0 40	1 - 12	1 7-16"	\$0 40
1 - 3	5-16	40	1 - 13	1 1-2	40
1 - 4	3-8	40	1 - 13	1 9-16	40
1 - 4	7-16	40.	1 - 14	1 5-8	40
1 - 5	1-2	40	1 - 14	1 11-16	40
1 - 5	9-16	40	1 - 15	1 3-4	60
1 - 6	5-8	40	1 - 15	1 13-16	60
1 - 6	11-16	40	1 - 16	1 7-8	60
1 - 7	3-4	40	1 - 16	1 15-16	60
1 - 7	13-16	40	1 - 17	2	60
1-8	7-8	40	1 - 17	2 1-16	60
1-8	15-16	40	1 - 18	2 1-8	60
1 - 9	1	40	1 - 18	2 3-16	60
1 - 9	1 1-16	40	1 - 19	2 1.4	60
1 - 10	11-8	40	1 - 19	2 5-16	60
1 - 10	1 3-16	40	1 - 20	2 3-8	. 60
1-11	1 1-4	40	1 - 20	2 7-16	60
1-11	1 5-16	40	1 - 21	2 1-2	60
1 - 12	1 3-8	40	1 - 21	2 9-16	60

For Nos. 2, 12 and 14.

Pattern No.	Diameter of Work.	Price each	Pattern No.	Diameter of Work.	Price each
2 - 3	1.4"	\$0 60	2 - 13	1 5-8"	\$0 60
2-3	5-16	60	2 - 13	1 11-16	60
2 - 3	3-8	60	2 - 14	1 3-4	80
2 - 3	7.16	60	2 - 14	1 13-16	80
2 - 4	1.2	60	2 - 15	1 7-8	80
2 - 4	9-16	60	2 - 15	1 15-16	80
2 - 5	5-8	60	2 - 16	2	SO
2 - 5	11-16	60	2 - 16	2 1-16	80
2 - 6	3-4	60	2 - 17	2 1-8	80
2 - 6	13-16	60	2 - 17	2 3-16	80
2 - 7	7-8	60	2 - 18	2 1-4	80
2 - 7	15-16	60	2 - 18	2 5-16	80
2 - 8	1	.60	2 - 19	2 3-8	80
2 - 8	1 1-16	60	2 - 19	2 7-16	80
2 - 9	1 1-8	60	2 - 20	2 1-2	80
2 - 9	1 3-16	60	2 - 20	2 9-16	80
2 - 10	1 1-4	60	2 - 21	2 5-8	80
2 - 10	1 5-16	60	2 - 21	2 11-16	80
2 - 11	1 3-8	60	2 - 22	2 3-4	80
2 - 11	1 7-16	60	2 - 22	2 13-16	80
2 - 12	1 1-2	60	2 - 23	2 7-8	80
2 - 12	1 9-16	60	2 - 23	2 15-16	80

List continued on next page.

165 **BRONZE SHOES** FOR UNIVERSAL BACK RESTS-Continued. For Nos. 2*. 12* and 14**.

Pattern No.	Diameter of Work.	Price each.	Pattern No.	Diameter of Work.	Price each.
2 - 24	3"	\$0 80	2 - 31	3 7-8"	\$1 00
2-24	3 1-16	80	2 - 31	3 15-16	1 00
2 - 25	3 1-8	1 00	2 - 32	4	1 00
2 - 25	3 3-16	1 00	2 - 32	4 1-16	1 00
2 - 26	3 1-4	1 00	2 - 32	41.8	1 00
2 - 26	3 5-16	1 00	2 - 33	4 1-4	1 25
2 - 27	3 3-8	1 00	2 - 34	4 1-2	1 25
2 - 27	3 7-16	1 00	2 - 35	4 3-4	1 25
2 - 28	3 1-2	1 00	2 - 36	5	1 25
2 - 28	3 9-16	1 00	2 - 37	5 1-4	1 25
2 - 29	3 5-8	1 00	2 - 38	5 1-2	1 25
2 - 29	3 11-16	1 00	2 - 39	5 3-4	1 25
2 - 30	3 3-4	1 00	2 - 40	6	1 25
2 - 30	3 13-16	1 00			

*Nos. 2 and 12 Universal Back Rests take shoes with capacity up to 4 1-8" diameter only. **No. 14 Combination Back Rest takes shoes with capacity

"No. 14 Combination Back Rest takes shoes with capacity up to 3 1-2" diameter only.
In ordering Bronze Shoes, give pattern number and diameter of work to be ground. For example:
If shoe is wanted for either the Nos. 2, 12 or 14 Universal Back Rests, to grind work to 11-16" in diameter, the order should read: 1 Bronze Shoe, No. 2-5, 11-16".

ADJUSTABLE BRONZE SHOES.

Patented Feb. 18, 1908.

These Bronze Shoes can be easily and quickly adjusted to any diameter of work within their capacity. They are intended for use in rapid commercial grinding; and are designed to be interchangeable in the same bearings with the solid Bronze Shoes.

For Nos. 1 and 11 Universal Back Rests.

Pattern No.	Diameter of Work.	Price each.
3-4	1" to 2 1-2"	\$1 75
For Nos. 2	and 12 Universal	Back Rests.
3 - 5 3 - 8	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\$175 \\ 250$
For No.	14 Universal Ba	ck Rest.
$ \begin{array}{r} *3 - 6 \\ 3 - 7 \\ 3 - 10 \\ 3 - 12 \end{array} $	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	\$175 175 250 275

*For No. 14 Combination Back Rest.

In ordering Adjustable Bronze Shoes, give pattern num-ber. For example: If shoe is wanted for either the No. 2 or No. 12 Universal Back Rest, to grind work of any diameter from 1'' to 2 1-2", order should read: 1 Adjustable Bronze Shoe, No. 3-5.

TABLE OF GRINDING WHEEL SPEEDS.

Showing Number of Revolutions per Minute Required for Specified Rates of Periphery Speed.

Surface Speed in feet.	For Surface Speed of 5000 feet.	For Surface Speed of 6000 feet.	For Surface Speed of 7000 feet.	For Surface Speed of 8000 feet.
Diam.	Revolutions per minute.	Revolutions per minute.	Revolutions per minute.	Revolutions per minute.
1″	19098.54	22918.25	26737.97	30557.68
2	9549.27	11459.12	13368.98	15278.84
3	6366.18	7639.41	8912.66	10185.89
4	4774.63	5729.56	6684.49	7639.42
5	3819.70	4583.65	5347.59	6111.54
6	3183.09	3819.70	4456.32	5092.94
7	2728.36	3274.03	3819.71	4365.38
8	2387.31	2864.78	3342.24	3819.71
10	1909.85	2291.83	2673.79	3055.77
12	1591.54	1909.85	2228.17	2546.47
14	1364.18	1637.02	1909.85	2182.69
16	1193.66	1432.39	1671.12	1909.85
18	1061.03	1273.24	1485.44	1697.65
20	954.92	1145.91	1336.90	1527.88
22	868.11	1041.74	1215.36	1388.98
24	795.77	954.93	1114.08	1273.23
. 30	636.61	763.94	891.26	1018.59
36	530,51	636.62	742.72	848.82

169

No. 3 26 in. x 8 in. and 36 in. x 8 in. AUTOMATIC GEAR CUTTING MACHINES.

- Cutter Spindle. 1" diameter. Hardened and ground. Can be removed and smaller sizes substituted. Other sizes carried in stock. Provided with means of compensation for wear. Balance wheel on end; maintains of compensation for wear. Balance wheel on end; maintains constant speed and pre-vents chattering. 12 changes of speed, 48 to 241 revolutions per minute. Speed changes in geometrical progression; obtained by change gears. Outer bearing on cutter slide gives additional support to cutter spindle. Feed of Cutter Slide. 16 changes, 7-8" to 16" per minute.
- Obtained by change gears. Changes in geometrical pro-gression. Return of cutter slide rapid and at constant speed; independent of speed and feed of cutter.
- Work Spindle Head. Adjusted by means of screw operated by hand wheel. Thrust of elevating screw taken by ball bearings. Dial graduated to thousandths of an inch indicates this adjustment.
- Work Spindle. Front end has No. 12 taper hole. Fitted to receive face plate or fixture. Hole through, 1 5-16" diameter.
- Overhanging Arm. Clears gears to 11 3-4" diameter. Adjustable centre.
- Outer Support. For end of work arbor. Takes all work to full capacity of machine. Has hole for outer bearing and adjustable centre. Additional support for large gears furnished by adjustable rest placed back of rim of gear. opposite cutter.
- Indexing Mechanism. Accurate. Independent of rate of feed and speed of cutter, so that indexing is as rapid when these are slow as when they are fast. Operates without shock. Feed mechanism disengaged while indexing; becomes
- operative only on completion of indexing. Index Change Gears. Provide for cutting all numbers of teeth from 12 to 50 and all numbers from 50 to 400, excepting prime numbers and their multiples.
- Counter-shaft. 1 pair of tight and loose pulleys, 12" diameter. 3 1-2" belt. Speed: 400 revolutions per minute.
- Floor Space. At right angles to cutter spindle, 77". Parallel to cutter spindle, 57".
- Weights. Net, about 3100 lbs.; ready for shipment, about 3500 lbs. Dimensions for shipment, 69" x 37" x 66". Space occupied, about 97 cubic feet.

Equipment. Pump and piping, indicator for setting cutter, tables, change gears, outer support for work arbor, wrenches and everything shown in cut, together with overhead works. Price. F.o.b. Providence, R. I. \$

MACHINE TO CUT SPUR GEARS TO 36" DIAMETER.

Floor Space. At right angles to cutter spindle, 77". Parallel to cutter spindle, 57".

Weights. Net, about 3150 lbs.; ready for shipment, about Weights. Net, about 5150 105.; ready for simplicit, about 3350 lbs. Dimensions for shipment, 69" x 37" x 71". Space occupied, about 101 cubic feet.
Price. F.o.b. Providence, R. I. \$
Arbors, Bushings, Collets, Sets of Tools, Attachments and Cutters, pages 84, 186 to 191, 369, 375, 381 and 384.



24 in x 8 in.

AUTOMATIC GEAR CUTTING MACHINE.

Patented March 13, 1900; Sept. 1, 1908.



Capacity. Spur gears to 24" diameter, 8" face. Cast iron, 3 diametral pitch; steel, 4 diametral pitch.

No. 3 HEAVY 24 in. x 8 in. AUTOMATIC GEAR CUTTING MACHINE.

- Cutter Spindle. 11-4" diameter. Hardened and ground. Can be removed and smaller sizes substituted. Other sizes carried in stock. Provided with means of compensation for wear. Balance wheel on end; maintains constant speed and prevents chattering. 12 changes of speed, 30 to 156 revolutions per minute. Speed changes in geometrical progression; obtained by change gears. Outer bearing on cutter slide gives additional support to cutter spindle.
- Feed of Cutter Slide. 16 changes, 13-16" to 15 3-4" per minute; obtained by change gears. Changes in geometrical progression. Return of cutter slide rapid and at constant speed, independent of speed and feed of cutter.
- Work Spindle Head. Adjusted by means of screw operated by hand wheel. Thrust of elevating screw taken by ball bearings. Dial graduated to thousandths of an inch indicates this adjustment.
- Work Spindle. Front end has No. 14 taper hole. Fitted to receive face plate or fixture. Hole through, 1 13-16" diameter.
- **Overhanging Arm.** Clears gears to 20" diameter. Adjustable centre in arbor support. Two bushings are furnished, with holes 13-16" and 1" diameter, which can be substituted in place of the centre. Arm brace furnished. Additional support for larger gears furnished by adjustable rest placed back of rim of gear, opposite cutter.
- Indexing Mechanism. Accurate. Independent of rate of feed and speed of cutter, so that indexing is as rapid when these are slow as when they are fast. Operates without shock. Feed mechanism disengaged while indexing; becomes operative only on completion of indexing.
- Index Change Gears. Provide for cutting all numbers of teeth from 12 to 50 and all numbers from 50 to 400, excepting prime numbers and their multiples.
- Counter-shaft. One pair of tight and loose pulleys, 14" diameter. 4" belt. Speed: 350 revolutions per minute.
- Floor Space. At right angles to cutter spindle, 85". Parallel to cutter spindle, 47".
- Weights. Net, about 4750 lbs. Ready for shipment, about 5400 lbs. Dimensions for shipment, 78" x 43" x 74". Space occupied, about 144 cubic feet.
- Equipment. Pump and piping, indicator for setting cutter, tables, change gears, wrenches and everything else shown in cut, together with overhead works.

Price. F.o.b. Providence, R. I. \$

Arbors, Bushings, Collets, Sets of Tools, Attachments and Cutters, pages 54, 186 to 191, 369, 375, 381 and 384.

No. 4 48 in. x 10 in. AUTOMATIC GEAR CUTTING MACHINE.

172

Patented March 13, 1900: Sept. 1, 1908.



Capacity. Spur gears to 48" in diameter, 10" face Cast iron, 3 diametral pitch; steel, 4 diametral pitch.

No. 4 48 in. x 10 in. AUTOMATIC GEAR CUTTING MACHINE.

- Cutter Spindle. 1 1-4" diameter. Hardened and ground. Can be removed and smaller sizes substituted. Other sizes carried in stock. Provided with means of compensation for wear. Balance wheel on end; maintains constant speed and prevents chattering. 12 changes of speed, 30 to 161 revolutions per minute. Speed changes in geometrical progression; obtained by change gears. Outer bearing on cutter slide gives additional support to cutter spindle.
- Feed of Cutter Slide. 16 changes, 13-16" to 15 3-4" per minute. Obtained by change gears. Changes in geometrical progression. Return of cutter slide rapid and at constant speed; independent of speed and feed of cutter.
- Work Spindle Head. Adjusted by means of screw operated by hand wheel. Thrust of elevating screw taken by ball bearings. Adjustable dial graduated to thousandths of an inch indicates this adjustment.
- Work Spindle. Front end has No. 14 taper hole. Fitted to receive face plate or fixture. Hole through, 1 13-16" diameter. Outer Support. For end of work arbor. Takes all work to full capacity of machine. Has hole for outer bearing and adjustable centre. Large gears supported by adjustable rest placed back of rim of gear, opposite cutter.
- Indexing Mechanism. Accurate. Independent of rate of feed and speed of cutter, so that indexing is as rapid when these are slow as when they are fast. Operates without shock. Feed mechanism disengaged while indexing; becomes operative only on completion of indexing.
- Index Change Gears. Provide for cutting all numbers of teeth from 12 to 50 and all numbers from 50 to 400, excepting prime numbers and their multiples.
- Counter-shaft. 1 pair of tight and loose pulleys, 14" diameter. 4 1-2" belt. Speed: 380 revolutions per minute.
- Floor Space. At right angles to cutter spindle, 85". Parallel to cutter spindle, 64".
- Weights. Net, about 4600 lbs.; ready for shipment, about 5300 lbs. Dimensions for shipment, 79" x 45" x 78". Space occupied, about 161 cubic feet.
- Equipment. Pump and piping, indicator for setting cutter, tables, change gears, wrenches and everything else shown in cut, together with overhead works.

Price. F.o.b. Providence, R. I. \$

Arbors, Bushings, Collets, Set of Tools, Attachments and Cutters, pages 84, 186 to 191, 370, 375, 381 and 384.

No. 5 60 in. x 11 in. AUTOMATIC GEAR CUTTING MACHINE.

174

Patented March 13, 1900; Sept. 1, 1908.



Capacity. Spur gears to 60" diameter, 11" face. Cast iron, 2 diametral pitch; steel, 3 diametral pitch.

No. 5 60 in. x 11 in. AUTOMATIC GEAR CUTTING MACHINE.

- Cutter Spindle. 1 1-2" diameter. Hardened and ground. Can be removed and smaller sizes substituted. Other sizes carried in stock. Provided with means of compensation for wear. Balance wheel on end; maintains constant speed and prevents chattering. 12 changes of speed, 25 to 102 revolutions per minute. Speed changes in geometrical progression; obtained by change gears. Outer bearing on cutter slide gives additional support to cutter spindle.
- Feed of Cutter Slide. 16 changes, 11-16" to 12 7-8" per minute. Obtained by change gears. Changes in geometrical progression. Return of cutter slide rapid and at constant speed; independent of speed and feed of cutter.
- Work Spindle Head. Adjusted by means of screw operated by crank. Thrust of elevating screw taken by ball bearings. Dial graduated to thousandths of an inch indicates this adjustment. Provision made for raising and lowering head by power.
- Work Spindle. Front end has No. 16 taper hole. Fitted to receive face plate or fixture. Hole through, 21-16" diameter.
- Outer Support. For end of work arbor. Takes all work to full capacity of machine. Has hole for outer bearing and adjustable centre. Additional support for large gears furnished by adjustable rest placed back of rim of gear, opposite cutter.
- Indexing Mechanism. Independent of feed and speed of cutter, so that indexing is as rapid when these are slow as when they are fast. Operates without shock. Feed mechanism disengaged while indexing; becomes operative only on completion of indexing.
- Index Change Gears. Provide for cutting all numbers of teeth from 12 to 50 and all numbers from 50 to 400, excepting prime numbers and their multiples.
- Withdrawing Expansion Arbor. Allows work to be placed in position and removed without disturbing adjustments.
- Counter-shaft. 1 pair of tight and loose pulleys, 18" diameter. 5" belt. Speed: 360 revolutions per minute.
- Floor Space. At right angles to cutter spindle, 103". Parallel to cutter spindle, 74".
- Weights. Net, about 7000 lbs.; ready for shipment, about 8000 lbs. Dimensions for shipment, 93" x 56" x 86". Space occupied, about 259 cubic feet.

Equipment. Pump and piping, indicator for setting cutter, tables, change gears, 3" expansion bushing, wrenches and everything else shown in cut, together with overhead works.

Price. F.o.b. Providence, R. I. \$

Arbors, Bushings, Collets, Set of Tools, Attachments and Cutters, pages 84, 186 to 191, 370, 376, 382 and 385.

No. 6 72 in. x 13 in. AUTOMATIC GEAR CUTTING MACHINE.

Patented March 13, 1900; Sept. 1, 1908.

Capacity. Spur gears to 72" diameter, 13" face. Cast iron, 1 3-4 diametral pitch; steel, 2 diametral pitch.

No. 6 72 in. x 13 in. AUTOMATIC GEAR CUTTING MACHINE.

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- Cutter Spindle. 13-4" diameter. Hardened and ground. Can be removed and smaller sizes substituted. Other sizes carried in stock. Provided with means of compensation for wear. Balance wheel on end; maintains constant speed and prevents chattering. 12 changes of speed, 19 to 76 revolutions per minute. Speed changes in geometrical progression; obtained by change gears. Takes roughing and finishing cutters at the same time. Outer bearing on cutter slide gives additional support to cutter spindle.
- Feed of Cutter Slide. 16 changes, 11-16" to 12 7-8" per minute. Obtained by change gears. Changes in geometrical progression. Return of cutter slide rapid and at constant speed; independent of speed and feed of cutter.
- Work Spindle Head. Adjusted by means of screw operated by crank. Thrust of elevating screw taken by ball bearings. Dial graduated to thousandths of an inch indicates this adjustment. Provision made for raising and lowering head by power.
- Work Spindle. Front end has No. 18 taper hole. Fitted to receive face plate or fixture. Hole through, 2 3-8" diameter.
- Outer Support. For end of work arbor. Easily moved by crank at front. Takes all work to full capacity of machine. Has hole for outer bearing and adjustable centre. Additional support for large gears furnished by adjustable rest placed back of rim of gear, opposite cutter.
- Indexing Mechanism. Independent of feed and speed of cutter, so that indexing is as rapid when these are slow as when they are fast. Operates without shock. Feed mechanism disengaged while indexing; becomes operative only on completion of indexing.
- Index Change Gears. Provide for cutting all numbers of teeth from 12 to 50 and all numbers from 50 to 400, excepting prime numbers and their multiples.
- Withdrawing Expansion Arbor. Allows work to be placed in position and removed without disturbing adjustments.
- Counter-shaft. 1 pair of tight and loose pulleys, 18" diameter. 7" belt. Speed: 340 revolutions per minute.
- Floor Space. Right angles to cutter spindle, 120". Parallel to cutter spindle, 87".
- Weights. Net, about 11,000 lbs.; ready for shipment, about 12,600 lbs. Dimensions for shipment, 108" x 65" x 99". Space occupied, about 402 cubic feet.
- Equipment. Pump and piping, indicator for setting cutter, tables, change gears, 4" expansion bushing, wrenches and everything else shown in cut, together with overhead works. Price. F.o.b. Providence, R. I. \$

Arbors, Bushings, Collets, Set of Tools, Attachments and Cutters, see pages 84, 186 to 191, 371, 376, 382 and 385.
No. 13 18 in. x 4 in.

AUTOMATIC GEAR CUTTING

MACHINE.

Patented Feb. 6, March 13, 1900; Jan. 26, 1904; Sept. 1, 1908.



Capacity. Spur and bevel gears to 18" diameter, 4" face. Cast iron, 4 diametral pitch; steel, 5 diametral pitch.

No. 13 18 in. x 4 in. AUTOMATIC GEAR CUTTING MACHINE.

179

For Spur and Bevel Gears.

- Cutter Spindle, 7-8" diameter. Hardened and ground. Provided with means of compensation for wear. Balance wheel on end; maintains constant speed and prevents chattering. 12 changes of speed, 48 to 241 revolutions per minute. Speed changes in geometrical progression; obtained by change gears. Outer bearing on cutter slide gives additional support to cutter spindle. Bushings furnished take cutters with 1" and 1 1-4" hole.
- Cutter Slide. Carriages adjustable to any angle to 90°. Graduated arc indicates angle of elevation. Cutter can be set either side of centre when cutting bevel gears. Vernier graduated to thousandths of an inch indicates adjustment. Return of cutter slide rapid and at constant speed; independent of speed and feed of cutter.
- Feed of Cutter Slide. 16 changes, 7-8" to 16" per minute. Obtained by change gears. Changes in geometrical progression.
- Work Spindle Head. Adjusted by means of screw operated by hand wheel. Thrust of elevating screw taken by ball bearings. Dial, graduated to thousandths of an inch, indicates this adjustment.
- Work Spindle. Front end tapered on outside; fitted to receive face plate or fixture. Has No. 12 taper hole. Hole through. 1 5-16" diameter.
- Overhanging Arm. Clears gears to 11 3-4" diameter. Larger gears supported by adjustable rest placed back of rim of gear, opposite cutter. Adjustable centre. Indexing Mechanism. Accurate. Independent of rate of feed
- and speed of cutter, so that indexing is as rapid when these are slow as when they are fast. Operates without shock. Feed mechanism disengaged while indexing; becomes oper-ative only on completion of indexing.
- Index Change Gears. Provide for cutting all numbers of teeth from 12 to 50 and all numbers from 50 to 400, excepting prime numbers and their multiples.
- Counter-shaft. One pair of tight and loose pulleys, 12" diam-
- eter. 3 1-2" belt. Speed: 310 revolutions per minute. Floor Space. At right angles to cutter spindle, 75". Parallel to cutter spindle, 57".
- Weights. Net, about 3350 lbs. Ready for shipment, about 3800 lbs. Dimensions for shipment, 69" x 39" x 66". Space occupied, about 103 cubic feet.
- Equipment. Pump and piping, indicator for setting cutter. change gears, wrenches and everything else shown in cut. together with overhead works.

Price. F.o.b. Providence, R. I. \$

Arbors, Busnings, Collets, Sets of Tools and Cutters, pages 84, 186 to 191, 371 and 372.

No. 13 HEAVY 24 in. x 6 in. AUTOMATIC GEAR CUTTING MACHINE. Patented February 6, March 13, 1900; September 1, 1908.

Capacity. Spur and bevel gears to 24" diameter, 6" face. Cast iron, 3 diametral pitch; steel, 4 diametral pitch.

No. 13 HEAVY 24 in. x 6 in. AUTOMATIC GEAR CUTTING MACHINE.

181

- Cutter Spindle. 1 1-4" diameter. Hardened and ground. Can be removed and smaller sizes substituted. Other sizes carried in stock. Provided with means of compensation for wear. Balance wheel on end; maintains constant speed and prevents chattering. 12 changes of speed, 30 to 156 revolutions per minute. Speed changes in geometrical progression; obtained by change gears. Outer bearing on cutter slide gives additional support to cutter spindle.
- cutter slide gives additional support to cutter spindle. Cutter Slide. Carriage adjustable to any angle to 90°. Graduated arc indicates angle of elevation. Cutter can be set either side of centre when cutting bevel gears. Vernier graduated to thousandths of an inch indicates adjustment. Return of cutter slide rapid and at constant speed; independent of speed and feed of cutter.
- pendent of speed and feed of cutter.
 Feed of Cutter Slide. 16 changes, 13-16" to 15 3-4" per minute; obtained by change gears. Changes in geometrical progression.
- Work Spindle Head. Adjusted by means of screw operated by hand wheel. Thrust of elevating screw taken by ball bearings. Dial, graduated to thousandths of an inch, indicates this adjustment.
- Work Spindle. Front end tapered on outside; fitted to receive face plate or fixture. Has No. 14 taper hole. Hole through, 1 13-16" diameter.
- Overhanging Arm. Clears gears to 20" diameter. Larger gears supported by adjustable rest placed back of rim of gear, opposite cutter. Adjustable centre.
- gears supported by adjustable fest placed back of rin of gear, opposite cutter. Adjustable centre. Indexing Mechanism. Accurate. Independent of rate of feed and speed of cutter, so that indexing is as rapid when these are slow as when they are fast. Operates without shock. Feed mechanism disengaged while indexing; becomes operative only on completion of indexing.
- comes operative only on completion of indexing. Index Change Gears. Provide for cutting all numbers of teeth from 12 to 50 and all numbers from 50 to 400, excepting prime numbers and their multiples.
- Counter-shaft. One pair of tight and loose pulleys, 14" diameter. 4" belt. Speed: 350 revolutions per minute.
- Floor Space. At right angles to cutter spindle, 103". Parallel to cutter spindle, 47".
- Weights. Net, about 6000 lbs. Ready for shipment, about 6750 lbs. Dimensions for shipment, 98"x 43"x 74". Space occupied, about 180 cubic feet.
- Equipment. Pump and piping, indicator for setting cutter, change gears, wrenches and everything else shown in cut, together with overhead works.

Price. F.o.b. Providence, R. I. \$

Arbors, Bushings, Collets, Sets of Tools, Attachments and Cutters, pages 84, 186 to 191, 369, 375, 381 and 384.

180

No. 1 SPUR GEAR TESTING MACHINE.

No1

182

GREATEST DISTANCE BETWEEN CENTRES, 29 1-2". LEAST DISTANCE BETWEEN CENTRES, 2".

00000000

This machine consists of a bed mounted on legs carrying one fixed head and one movable head.

These heads are provided with hardened steel bushings having taper holes in which are mounted the studs that carry the work. Bushings can be used on the studs for testing gears with larger holes. The lever at the left front of bed is for removing the studs and the lever on top for clamping the slide. The centre distance reads to thousandths of an inch by means of a scale on bed and vernier plate on the sliding head. Metric scales, studs and bushings can be furnished in place of English when so ordered.

No. 1 SPUR GEAR TESTING MACHINE.

183

(CONTINUED)

Floor Space. 51 5-8" x 21".

Weights. Net, about 370 lbs.; ready for shipment, about 500 lbs. Dimensions for shipment, 56" x 23" x 20". Space occupied, about 15 cubic feet.

Equipment. 4 studs: 2, 5-8" diameter; 2, 15-16" diameter; and 4 bushings: 2, 1" diameter, 5-8" hole; and 2, 1 1-2" diameter, 15-16" hole.

Price. F.o.b. Providence, R. I. \$

Extra studs, 1-4" to 15-16" by 16ths, can be furnished. Price each, \$2 50.

Extra bushings, 1" to 3" by 16ths, can be furnished. Price each, \$1 50.

No. 0 SPUR GEAR TESTING MACHINE.

This machine is similar in design to the No. 1 Spur Gear Testing Machine, but of smaller capacity, the bed being shorter and mounted on very short legs. It is usually set on the work bench, and can be conveniently moved about. It is operated in the same manner as the No. 1 Spur Gear Testing Machine described on the opposite page.

Floor Space. 14 1-4" x 6".

- Weights. Net, about 26 lbs.; ready for shipment, about 41 lbs. Dimensions for shipment, 19" x 9" x 10". Space occupied, about 1 cubic foot.
- Equipment. 12 studs: 2, 3-16" diameter; 2, 1-4" diameter; 2, 5-16" diameter; 2, 3-8" diameter; 2, 7-16" diameter; 2, 1-2" diameter; and 4 bushings: 2, 9-16" diameter, 1-4" hole; 2, 5-8" diameter, 1-4" hole. Price. F.o.b. Providence, R. I. \$

No. 1 BEVEL GEAR TESTING MACHINE.

184

For Testing Bevel Gears, also Worms and Worm Wheels.



Distance, end of spindle in vertical slide to centre of stud on horizontal slide with slide flush with end of bed, 24".

Distance, centre of spindle in horizontal slide to centre of spindle in vertical slide with vertical slide flush with top of upright, 11".

Distance, centre of spindle in vertical slide to under side of overhanging arm, 5 7-8".

185 No. 1

BEVEL GEAR TESTING MACHINE.

For Testing Bevel Gears,

also Worms and Worm Wheels.

This machine consists of a bed that is mounted on a base and has horizontal and vertical slides for supporting the gears.

- Horizontal Slide. Operated by hand wheel on front of bed. Carries a bracket in which is mounted a revolving spindle having a No. 10 taper hole. Also carries a head pivoted to its side having a revolving spindle in which is mounted a work carrying stud. Bushings can be used to adapt stud to various sizes of holes. Head can be adjusted 40° either way to allow for testing bevels of other angles than 90°. Two locating pins provided to bring spindle at right angles. Distance, face of spindle in vertical slide to centre of stud with slide flush with end of bed, 24"; with slide overhanging, 26".
- Vertical Slide. Operated by hand wheel mounted on front off slide. Carries a revolving spindle having a No. 10 taper hole. Provided with an overhanging arm having an adjustable centre and a stop to bring centre in line with the spindle. Centre of spindle to under side of arm, 5 7-8". A collet and centre for spindle provides means for mounting worms or wheels on centres. Work 11 1-2" in diameter and 10 1-2" in length can be held in this way. Spring chuck with hole 1 1-2" diameter provided for holding worms or pinions by the shank. Scale on upright and vernier plate on vertical slide give centre distance in thousandths of an inch. Metric scales, studs and bushings can be furnished in place of English when desired. Distance, centre of spindle in horizontal slide to centre of spindle in vertical slide with vertical slide flush with top of upright, 11"; with slide overhanging, 14".

In testing bevel gears, the bracket is removed from the horizontal slide and the bevel gear is mounted on the stud of the slide. The pinion is mounted on an arbor in the spindle of the vertical slide or held in the spring chuck.

In testing worms and worm wheels, the worm is mounted on an arbor in the spindle of the bracket on the horizontal slide and the worm wheel is mounted on an arbor in the spindle of the vertical slide or held in the spring chuck.

Floor Space. 51 1-8" x 26 1-4".

Weights. Net, about 1350 lbs.; ready for shipment, about 1650 lbs. Dimensions for shipment, 52" x 29" x 61". Space occupied, about 53 cubic feet.

Equipment. Spring chuck, taper collet, driving centre, wrenches, 5-8" stud and a 1" bushing.

Price. F.o.b. Providence, R. I. \$

Extra studs, 1-4" to 15-16" by 16ths, can be furnished. Price, each, \$2 50.

Extra bushings, 1" to 3" by 16ths, can be furnished. Price, each, \$1 50.

TOOLS FOR USE ON AUTOMATIC GEAR CUTTING MACHINES.

They are shipped with each machine. If not wanted, pack carefully and return by express, at our expense.

Nos. 3 & 13 Automatic Gear Cutting Machines.

V Collet and No. 10 Key. One each I, J and K Arbors. Eleven Bushings, as follows:

For I Arbor, 3-4" x 3", 7-8" x 3", 1" x 3", 1 1-8" x 3".
For J Arbor, 1 1-4" x 3 1-2", 1 3-8" x 3 1-2", 1 1-2" x 3 1-2", 1 5-8" x 3 1-2".

For K Arbor, 1 3-4" x 3 1-2", 2" x 3 1-2", 2 1-4" x 3 1-2". For J and K Arbors, 2 1-2" Spanner Wrench.

Price, \$

DO RO DEDURY D

Nos. 3H & 4 Automatic Gear Cutting Machines.

W Collet and No. 11 Key. One each M, N and O Arbors. Twelve Bushings, as follows:

For M Arbor, 1" x 3 1-2", 1 1-8" x 3 1-2", 1 1-4" x 3 1-2", 1 3-8" x 3 1-2".

For N Arbor, 1 1-2" x 5", 1 5-8" x 5", 1 3-4" x 5", 2" x 5". For O Arbor, 2 1-4" x 5", 2 1-2" x 5", 2 3-4" x 5", 3" x 5".

For M Arbor, 2" Spanner Wrench.

*For N and O Arbors, 1 1-2" Standard Wrench.

*For N and O Arbors, 3 1-4" Spanner Wrench.

Price, \$

*For No. 3 Heavy only.

For Arbors, Bushings and Collets, see pages 84, 190 and 191.

TOOLS FOR USE ON AUTOMATIC GEAR CUTTING MACHINES.

(CONTINUED)

No. 5 Automatic Gear Cutting Machine.

X Collet and No. 12 Key. One each, Q, R and S Arbors. Nine Bushings, as follows: For Q Arbor, 1 1-2" x 4 1-2", 1 5-8" x 4 1-2", 1 3-4" x 4 1-2", 2" x 4 1-2", 2 1-4" x 4 1-2". For R Arbor, 2 1-2" x 6", 2 3-4" x 6". For S Arbor, 3 1-4" x 6, 3 1-2" x 6". For R and S Arbors, 2 1-2" Spanner Wrench. Price, \$ Bushing, 3" x 6", furnished with machine.

No. 6 Automatic Gear Cutting Machine.

Y Collet and No. 14 Key. One each U, V and W Arbors. Nine Bushings, as follows: For U Arbor, 2 1-4" x 6", 2 1-2" x 6", 2 3-4" x 6". For V Arbor, 3" x 7 1-2", 3 1-4" x 7 1-2", 3 1-2" x 7 1-2", 3 3-4" x 7 1-2". For W Arbor, 4 1-2" x 9", 5" x 9". For V and W Arbors, 2 1-2" Standard Wrench. Price, \$

Bushing, 4" x 7 1-2", furnished with machine.

No. 13H Automatic Gear Cutting Machine.

W Collet and No. 11 Key. One each, M, P and T Arbors. Twelve Bushings, as follows:

For M Arbor, 1" x 3 1-2", 1 1-8" x 3 1-2", 1 1-4" x 3 1-2" 1 3-8" x 3 1-2".

For P Arbor, 1 1-2" x 5", 1 5-8" x 5", 1 3-4" x 5", 2" x 5".

For T Arbor, 2 1-4" x 5", 2 1-2" x 5", 2 3-4" x 5", 3" x 5".

For M Arbor, 2" Spanner Wrench.

For P and T Arbors, 1 1-2" Standard Wrench.

For P and T Arbors, 3 1-4" Spanner Wrench.

For Arbors, Bushings and Collets, see pages 84, 190 and 191.

INTERNAL GEAR CUTTING ATTACHMENTS.

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For Nos. 3, 3H, 4, 5, 6 and 13H Automatic Gear Cutting Machines.



When ordering, give size and construction number of machine.

The Holder or Frame is secured to the cutter slide and the cutter spindle of the Attachment is driven by the main cutter spindle of the machine through a train of gears.

All cylindrical bearings are hardened and ground.

Diameter of Cutters for No. 3, 2 3-4"; No. 3H, 3 5-8"; No. 4, 3 1-2"; No. 5, 4 1-2"; No. 6, 4 3-4".

Diameter of Arbors for No. 3, 1"; No. 3H, 1 1-4"; No. 4, 1 1-4"; No. 5, 1 1-2"; No. 6, 1 3-4".

Dimensions of boxes in which Attachments are shipped: No. 3, 19" x 10" x 9"; occupies about 1 cubic foot. No. 3H, 19"x 11"x 11"; occupies about 2 cubic feet. No. 4, 20"x 12"x 10"; occupies about 2 cubic feet. No. 5, 27" x 14" x 12"; occupies about 3 cubic feet. No. 6, 28"x 18"x 12"; occupies about 3 1.2 cubic feet.

No.	Machine where used.	Widest face that can be cut.	Smallest Inside Dia. of Gear that can be cut.	Coarsest Pitch that can be cut.	Approx. Shipmnt Weights	Price.
3 3H	3 3H, 13H	21.8'' 21.4	3 1.4"	9	60	99-0
4	4	3 1-2	4 1-4	6	100	0.00
56	56	4 1-4 5	5 1-4 6 1-2	4	145	8.4

QUILL GEAR CUTTING ATTACHMENTS.

For Nos. 3, 3H, 4 and 13H Automatic Gear Cutting Machines.



When ordering, give size and construction number of machine.

These Attachments are for cutting the small members of quill gears, or gears of similar construction. They are easily and quickly placed in position or removed. The cutter spindle is raised above the cutter spindle of the machine and driven by a train of gears.

Dimensions of boxes in which attachments are shipped: No. 3, $18'' \ge 11'' \ge 10''$; occupies about 1 cubic foot. No. 3H, $18'' \ge 14'' \ge 11''$; occupies about 1 1-2 cubic feet. No. 4, $19'' \ge 14'' \ge 11''$; occupies about 1 1-2 cubic feet.

No.	Machine where used.	Coarsest Pitch that can be cut.	Diam. of Cutter.	Greatest Diffrence in Diam. Large and Small Gear.	Net Weights	Price.
3 3H 4	3 3H,13H 4	6 4 4	$3 \ 3-4'' \\ 4 \ 3-4 \\ 5$	9" 13 13 1-2	40 80 80	60 60 60

190

AUTOMATIC FEED STOP For Automatic Gear Cutting Machines.

The Automatic Feed Stop will be found useful, when it is desired to cut segments, or only part way around a blank, and also when the accuracy required does not permit of the cutter passing through the same space twice.

The stop is attached to the back of the feed case and is operated by the reversing rod at the back of the machine. A graduated dial is set for the number of teeth to be cut. The feed stops at the end of the return stroke of the cutter slide when the zero lines on the stop coincide.

Price, \$

WORK ARBORS. Automatic Gear Cutting Machines.

Mark.	Machine where used.	No. of Taper of Shank.	Length of Bushing.	No. of Taper for Bushing.	Smallest Possible Bushing.	Price.
DEFG1JKMNOPQRSTUVW	No. 12 No. 12 No. 12 S & 13 S & 13 S & 13 S & 13 SH, 4 & 13H SH & 4 SH & 4 No. 13H No. 5 No. 5 No. 5 No. 5 No. 6 No. 6 No. 6 No. 6	$\begin{array}{c} 7\\ 10\\ 10\\ 10\\ 12\\ 12\\ 12\\ 11\\ 14\\ 14\\ 14\\ 14\\ 12\\ 16\\ 16\\ 16\\ 14\\ 14\\ 18\\ 18\\ 18\\ 18\end{array}$	3'' 3 1.2 1 1.2 3 1.2 3 1.2 3 1.2 3 1.2 3 1.2 5 5 4 1.2 6 6 5 6 7 1.2 9	$\begin{array}{c} 6\\ 9\\ 7\\ 6\\ 9\\ 11\\ 7\\ 10\\ 12\\ 10\\ 10\\ 13\\ 14\\ 12\\ 12\\ 14\\ 18\\ 18\\ \end{array}$	$\begin{array}{c} 3.4''\\ 1 & 1.4\\ & 7.8\\ 3.4\\ 1 & 1.4\\ 1 & 3.4\\ 1\\ 1 & 1.2\\ 2\\ 1 & 1.2\\ 2 & 1.2\\ 3 & 1.4\\ 2 & 1.4\\ 2 & 1.4\\ 3\\ 4\end{array}$	

Arbors marked * are for use in the Collets.

† Straight arbor; length from shoulder to nut 3", dia. 1-2".

EXPANSION BUSHINGS FOR WORK ARBORS.

Outsid e Diameter.	Machine where used.	Length.	No. Taper Hole.	Used with Arbor.	Price.
7-8"	No. 12	1 1-2"	7"	G	\$0 90
1	No. 12	1 1-2	7	G	90
11-8	No. 12	1 1-2	7	G	90
1 1-4	No. 12	1 1-2	7	G	90
3-4	3, 12 & 13	3	6	E&I	1 00
7-8	3,12 & 13	3	6	EXI	1 00
1	3,12 & 13	3	6	EXI	1 00
11.8	3, 12 & 13	910	0	E & I	1 20
1 1-4	0, 12 0 10	0 1-2	9	F&T	1 55
1 0-0	2 12 & 12	2 1 9	9	F&J	1 55
1 5 8	3 12 & 13	2 1.2	9	F&T	1 90
1 3.4	Nos. 3 & 13	3 1-2	11	K	1 90
2	Nos. 3 & 13	3 1-2	ÎÎ	K	2 20
2 1.4	Nos. 3 & 13	3 1-2	11	K	2 20
1	3H,4 & 13H	3 1-2	7	M	1 05
1 1-8	3H,4 & 13H	3 1-2	7	M	1 05
1 1-4	3H,4 & 13H	3 1-2	7	M	1 30
1 3-8	3H, 4 & 13H	3 1-2	7	M	1 55
1 1-2	3H, 4 & 13H	5	10	N&P	1 00
1 5-8	3H, 4 & 13H	5	10	NAP	1 90
1 3-4	011,4 & 1013	9	10	N&P	1 90
2	311,4 & 1311	5	10	0 & T	2 20
514	3H 4 & 18H	5	12	OXT	2 20
212	311.4 & 1311	5	12	O&T	2 65
2 3.4	3H.4 & 13H	5	12	O&T	3 10
3	3H,4&13H	5	12	O&T	3 50
1 1-2	No.5	4 1-2	10	Q	1 55
1 5-8	No. 5	4 1-2	10	Q	1 90
1 3-4	No. 5	4 1-2	10	Q	1 90
2	No. 5	4 1-2	10	Q	2 20
2 1-4	No. 5	4 1-2	10	8	2 20
*2 1-2	NO.D	b c	13	D	2 00
*2 3-4 +*9	NO.5	6	10	P	3 50
*3 1 4	No.5	6	13	R	3 50
314	No. 5	6	14	S	3 50
*3 1-2	No. 5	6	13	R	3 60
3 1-2	No. 5	6	14	S	3 60
2 1-4	No. 6	6	12	U	2 20
2 1-2	No. 6	6	12	U	2 65
2 3-4	No.6	6	12	U	3 10
*3	NO. 6	7 1-2	14	V	3 65
*3 1-4	NO.6	7 1-2	14	V	3 80
*2 2 4	NO.6	719	14	V	4 00
+*1	No.6	712	14	V V	4 30
4	No 6	9	18	w	4 50
4 1.2	No. 6	9	18	w	5 00
5	No. 6	9	18	W	5 50

In ordering, state outside diameter, and letter of Arbor. Bushings marked * can be used on Withdrawing Work Arbors furnished.

Bushings marked † are furnished with the machine.

EXPANSION BUSHINGS FOR WORK ARBORS.

TABLE OF CUTTING SPEEDS.

FT. PER MINUTE	15	17.5	20	22.5	25	27.5	30	35	40	45	50	55		
DIAM.		RE	VOL	UT	ION	IS	PER MINUTE							
1/16	917	1070	1222	1375	1528	1681	1833	2139	2445	2750	3056	3361		
1/8	458	535	611	688	764	840	917	1070	1222	1375	1528	1681		
3/16	306	357	407	458	509	560	611	713	815	917	1019	1120		
1/4	229	267	306	344	382	420	458	535	611	688	764	840		
5/16	183	214	244	275	306	336	367	428	489	550	611	672		
3/9	153	178	204	229	255	280	306	357	407	458	509	560		
7/18	131	153	175	196	218	240	262	306	349	393	437	480		
1/0	115	134	153	172	191	210	229	267	306	344	382	420		
5/8	91 7	107	192	138	153	168	183	214	244	275	306	336		
3/4	764	89 1	102	115	197	140	153	178	204	229	255	280		
7/9	65.5	76.4	87.3	08.9	109	120	131	153	175	196	218	240		
10	57.9	66.8	76.4	05.0	05.5	105	115	194	159	179	101	210		
TIO	50.0	50.4	67.0	70.0	21.0	1002 A	109	110	100	152	170	197		
11/4	150	50 5	61.3	20 0	01.0 70 A	94.0	01.7	107	100	100	159	160		
19/0	40.8	40.0	01.1 EE C	00.0	10.4 00 F	76.4	02.0	07.0	111	100	120	152		
108	41.1	40.0	20.0	62.0	09.0	70.4	76.4	- 91.2	100	120	100	140		
142	08.2	41.0	00.9	01.0	03.1	10.0	10.4	00.0	102	110	12/	140		
10/8	30.0	41.1	47,0	52.9	58.8	04.0	10.0	02.0	94.0	100	118	129		
13/4	32.1	38.2	43.1	49.1	54.0	60.0	65.5	76.4	01.0	98.2	109	120		
17/8	30.6	35.1	40.7	45.8	50.9	56.0	61.1	11.3	81.0	91.7	102	112		
2	28.7	35.4	38.2	43.0	47.7	52.5	51.3	66.8	70.4	85.9	95.0	105		
214	25.5	29.7		38.2	42.4	46.7	50.9	59.4	67.9	76.4	84.9	93.4		
21/2	22.9	26.7	\$0.6	34.4	38.2	42.0	45.8	53.5	61.1	68.8	76.4	84.0		
23/4	20.8	24.3	27.8	\$1.3	34.7	38.2	41.7	48.6	55.6	62.5	69.5	76.4		
3	19.1	22.3	25.5	28.6	31.8	35.0	38.2	44.6	50.9	57.3	63.7	70.0		
31/4	17.6	20.6	23.5	26.4	29.4	32.3	35.3	41.1	47.0	52.9	58.8	64.6		
31/2	16.4	19.1	21.8	24.5	27.3	30.0	32.7	38.2	43.7	49.1	54.6	60.0		
3 3/4	15.3	17.8	20.4	22.9	25.5	28.0	30.6	35.7	40.7	45.8	50.9	56.0		
4	14.3	16.7	19.1	21.5	23.9	26.3	28.7	33.4	38.2	43.0	47.7	52,5		
41/2	12.7	14.9	17.0	19.1	21.2	23.3	25.5	29.7	34.0	38.2	42.4	46.7		
5	11.5	13.4	15.3	17.2	19.1	21.0	22.9	26.7	30.6	34.4	38.2	42.0		
51/2	10.4	12.2	13.9	15.6	17.4	19.1	_ 20.8	24.3	27.8	31.3	34.7	38.2		
6	9.5	11.1	12.7	14.3	15.9	17.5	19.1	22.3	25.5	28.6	31.8	35.0		
61/2	8.8	10.3	11.8	13.2	14.7	16.2	17.6	20.6	23.5	26.4	29.4	32.3		
13	8,2	9.5	10,9	12.3	13,6	15.0	16.4	19.1	21.8	24.5	27.3	30.0		
712	7.6	8.9	10.2	11.5	12.7	14.0	15.3	17.8	20.4	22.9	25.5	28.0		
8	7.2	8.4	9.5	10.7	11.9	13.1	14.3	16.7	19:1	21.5	23.9	26.3		
81/2	6.7	7.9	9.0	10.1	11.2	12.4	13.5	15.7	18.0	20.2	22.5	24.7		
9	6.4	7.4	8.5	9.5	10.6	11.7	12.7	14.9	17.0	19.1	21.2	23.3		
912	6.0	7.0	8.0	- 9.1	10.1	11.1	12,1	14.1	16.1	18.1	20,1	22.1		
10	5.7	6.7	7.6	8.6	9.5	10.5	11.5	13.4	15,3	17.2	19.1	21.0		
11	5.2	6.1	6.9	7.8	8.7	9.5	10.4	12.2	13.9	15.6	17.4	19.1		
12	4.8	5.6	6.4	7.2	8.0	8.8	9.5	11.1	12.7	14.3	15.9	17.5		
13	4.4	5.1	5.9	6.6	7.3	8.1	8.8	10.3	11.8	13.2	14.7	16.2		
14	4.1	4.8	5.5	6.1	6.8	7.5	8.2	9.5	10.9	12.3	13.6	15.0		
15	3.8	4.5	5.1	5.7	6.4	7.0	7.6	8.9	10.2	11.5	12.7	14.0		
16	3.6	4.2	4.8	5.4	6.0	6.6	7.2	8.4	9.5	10.7	11.9	13.1		
17	3.4	3.9	4.5	5.1	5.6	6.2	6.7	7.9	9.0	10.1	11.2	12.4		
18	32	3.7	42	4.8	5.3	5.8	6.4	7.4	8.5	9.5	10.6	11.7		
	15	17.5	20	22.5	25	27.5	30	35	40	45	50	55		

Antipation in the little further further that the the second second

TABLE OF CUTTING SPEEDS.

(CONTINUED.)

FT. PER	60	65	17	0	75	80	90	10	00	11	10 1	120	130	14	0 1	50
MINUTE	00	DE	10	1 1	TI	0	NS		PI	EF	2	MI	NU	T	E	
DIAM.	2887	2072	1427	18 4	584	1889		1	A	2			0070	107	0 4	104
1/0	1833	1986	21	39 2	292	2445	2750	305	56	336	51 3	667	3913	421	0 2	056
3/10	1222	1324	145	26 1	528	1630	1833	208	37	22		445	2048	200	0 9	202
1/4	917	993	107	70 1	146	1222	1375	152	28_	16	81 1	833	1560	171	1 1	833
5/16	733	794	8	56	917	978	1100	12	22	13	10 J	1000	1394	14	6 1	528
3/8	611	662	17	13	764	815	917	10	19	11	20 1	1048	1135	12	22 1	310
7/16	524	568	6	11	655	698	786	81	10	8	10	917	993	10	70 1	146
1/2	458	497	5	35	573	611_	688	1	11	6	79	733	794	8	6	917
5/8	367	397	4	28	458	489	550	5	00	5	30	611	662	71	13	764
3/4	306	331	3	57	382	407	400	14	27	4	80	524	568	6	11	655
7/8	262	284	3	06	321	349	944	2	89	4	20	458	497	5	35	573
1	229	248	2	67	28/	079	206	2	40	3	73	407	441	47	75	509
11/8	204	221	2	38	255	214	975	3	06	13	36	367	397	4	28	458
11/4	183	199	2	14	009	1009	250	2	78	3	06	333	361	38	39	417
13/8	167	181	1	70	101	204	229	2	55	2	80	306	331	3	57	382
142	153	100		65	176	188	212	12	35	2	59	282	.306	3	29	353
1 5/8	141	100	1	153	164	175	196	2	18	2	40	262	284	3	06	321
1 3/4	101	192		43	153	163	183	2	04	2	24	244_	265	12	85	300
1 4/8	1122	104		134	143	153	172	1	91	2	10	229	248	- 2	07	201
101/1	102	110		119	127	136	153	1	170	11	87	204	221	- 2	14	990
0.1/2	2 91	7 99).3	107	115	122	138		53	1	68	183	199	- 4	04	208
23/	4 83	3 90	1.8	97.2	104	111	125]	139	1	53	16/	101	- +	72	191
3	76	4 8	2.8	89.1	95.5	102	115		127	1	40	100	159		65	176
31/	4 70	.5 70	3.4	82.3	88.2	94.	0 100		118	-14	29	101	149		53	164
31/	2 65	.5 70	0.9	76.4	81.9	87.	3 98	.2	109		120	101	130	51	43	153
33	4 61	.1 6	8.2	71.3	76,4	81.	5 91	1	102	2	105	115	112	1 1	34	143
4	57	.3 6	2,1	66,8	71.0	76.	4 80	.9	90.	0	02 /	102	111		119	127
41/	2 50	.9 5	5.2	59.4	63.6	67	9 70	0,4	70	1	84.0	91	7 99	.3 1	107	115
5	45	.8 4	9.7	53.5	57.2	61		0.0	60	5	76.4	83.	3 90).3	97.2	104
51	2 41	.7 4	5.1	48.6	52,	55	6 0	7.9	69	7	70.0	76.	4 8	2.8	89.1	95.5
6	38	3.2 4	1.4	44.6	47.2	5 00	0 5	2.0	58	8	64.6	70.	5 70	3.4	82,3	88.2
61	2 35	5.8 3	8.2	41.1	44.	1 41	7 4	01	54	6	60.0	65.	5 7	0.9	76.4	81.9
17	32	2.7 3	5.5	38.2	40,	9 40	7 4	58	50	9	56.0) 61.	1 6	6.2	71.3	76.4
31	2 30).6 3	3.1	30.1	00.		2 4	3.0	47	7	52.	5 57	.3 6	2.1	66.8	71.6
8	2	5.7 3	0.01	33.4 91 K	93	7 36	0 4	0.4	44	1.9	49.4	1 53	.9 5	8.4	62.9	67.4
81	<u>/2 2</u>	.0 2	10.4	00 7	21	8 34	0 3	8.2	42	2.4	46.	7 50.	.9 5	5.2	59.4	63.0
9	20	0.0 2	0.1	02 9	30	2 32	2 3	6.2	40):2	44.	2 48	3 5	2.3	56.2	5 60.2
91	2 2	1.1	20.1 24 Q	20,4	1 98	7 80	6 3	4.4	38	3.2	42.	0 45	.8 4	9.7	53.	0 01.
		2.8	22 6	24.5	3 26	0 27	.8 3	1.3	3	1.7	38.	2 41	.7 4	5.1	48.0	0 32.
1	0 1	01	20.7	22 5	3 23	9 2	5.5 2	28.6	3	1.8	35.	0 38	2 4	1.4	44.	1 44
	0 1	7.6	19.1	20.0	6 22	.0 2	3.5 2	26.4	2	9.4	32.	3 35	.3 3	0.2	41.	2 40
14	4 1	64	17.7	19.	1 20	5 2	1.8	24.5	2	7.3	30.	0 32	0 0	0.0	0.5	7 38
		5.3	16:6	17.	8 19	.1 2	0.4 5	22.9	_2	5,5	28,	0 30	0 0	10	32.	4 35
1	6 1	4.3	15.5	16.	7 17	.9 1	9.1	21.5	2	3.9	26.	3 28	0 0	0 2	31	5 33
1	7 1	3.5	14.6	15.	7 16	.9 1	8.0	20.2	2	2.5	24.	2 0	5 6	27 6	20	7 31
1	8 1	2.7	13.8	14.	9 15	.9 1	7.0	19.1	2	1.2	20.	0 20	0 1	00	140	150
T	6	0	65	70	75	8	0 9	00	10	00	.110	12	0 1	30	140	100

1 1-2 in. x 8 in.

PLAIN SCREW MACHINE.

194

No. 4

Patented Jan. 6, 1903.



This machine has a hole 1 9-16" in diameter through spindle and turns any length to 8".

195

No. 4

1 1-2 in. x 8 in. PLAIN SCREW MACHINE.

- Spindle. Of crucible steel. Bearings hardened, ground and lapped. Phosphor bronze boxes. Front box provided with means of compensation for wear. Thrust taken at rear end of spindle; bearing parts of hardened steel and phos. phor bronze. End threaded, 21-2" diameter, 4, U.S.S., R.H. Hole through, 1 9-16" diameter.
- Drive. Cone, 3 steps, largest 11" diameter. 3" belt. Friction back gears; operated by lever without stopping machine.
 12 changes of spindle speed direct, 35 to 545 revolutions per minute in geometrical progression; 6 reverse, 76 to 545.
- Turret. 8 holes, 1 3.4" diameter. Automatically clamped. Distance from centre of holes to top of slide, 3". Greatest distance between turret and front of spindle, 22 3.4". Stock 1 1-2" diameter can be fed through turret; special stop furnished if desired. Has gibs for vertical and transverse adjustments to compensate for wear. Each hole in turret has independent stop with screw adjustment. Turret slide bed has positive abutment to prevent backward movement from end thrust.
- Feed of Turret Slide. Automatic. Driven by chain direct-8 changes for each spindle speed, in geometrical progression from .003" to .034" per revolution of spindle. Changes obtained by lever on front of head without stopping spindle.
- **Cross Slide.** Adjustable stops for front and back tools. Dials read to .0005", to show setting. Tool posts are open on side toward chuck; have fine adjustment for the tools.
- Swing. Over bed, 15 1-4"; over cross slide, 7 3-4". Length that can be turned, 8".
- Tank Table. Has reservoir cast in bottom for collecting strained oil.
- Counter-shaft. 3 friction pulleys, 14" diameter. 4" belts. Speeds: direct, 157 and 333 rev. per minute; reverse, 333.
- Floor Space. Right angles to spindle, 30". Parallel to spindle, 90".
- Weights. Net, about 2200 lbs.; ready for shipment, domestic, about 2670 lbs.; foreign, about 2900 lbs. Dimensions for shipment, 75"x 31"x 30" and 95"x 32"x 22". Space occupied, about 40 cubic feet; about 39 cubic feet.
- Equipment. Pump and piping, wrenches, etc., together with overhead works.

Price. F.o.b. Providence, R. I. \$

Longitudinal Hand Feed for Cross Slide for adjustment purposes, \$ extra.

Automatic Transverse Feed for Cross Slide, \$ extra. Tools and Attachments, pages 236 to 275.

No. 6

2 in. x 10 in.

PLAIN SCREW MACHINE.

Back Geared.

Patented Jan. 6, 1903.



upparent, as 4,51 2 no 1997 so 2 as 2 as about 10 anha Lors: about 31 cubic fetta signment. Fump and piping, wrowalles, etc., t tertread tooks.

This machine has a hole 2 1-16" in diameter through spindle and turns any length to 10".

197

No. 6 2 in. x 10 in. PLAIN SCREW MACHINE. Back Geared.

Spindle. Of crucible steel. Bearings hardened, ground and lapped. Phosphor bronze boxes. Front box provided with means of compensation for wear. Thrust taken at rear end of spindle; bearing parts of hardened steel and phosphor bronze. End threaded, 3" diameter, 3 1-2" U.S.S., R.H. Hole through, 2 1-16" diameter.

- **Drive.** Cone, 3 steps, largest 11" diameter. 3" belt. Friction back gears; operated by lever without stopping machine. 12 changes of spindle speed direct, 30 to 450 revolutions per minute in geometrical progression; 6 reverse, 63 to 450.
- Turret. 7 holes, 2" diameter. Automatically clamped. Distance, centre of holes to top of slide, 3 5-8". Greatest distance between turret and front of spindle, 28". Flat surfaces for clamping special tools or fixtures. Has gibs for vertical and transverse adjustments to compensate for wear. Independent stop for each hole in turret facilitates setting tools. Turret slide bed has positive abutment to prevent backward movement from end thrust.
- Feed of Turret Slide. Automatic. Driven by chain direct. 8 changes for each spindle speed, in geometrical progression, .003" to .034" per revolution of spindle. Changes obtained by lever on front of head, without stopping spindle.

Swing. Over bed, 18"; over cross slide, 8 3-4". Length that can be turned, 10".

Tank Table. Has large reservoir cast in bottom for collecting strained oil.

Cross Slide. Adjustable stops for front and back tools. Dials read to .0005" to show setting. Tool posts are open on side toward chuck; have fine adjustment for tools.

Counter-shaft. 3 friction pulleys, 14" diameter. 4" belts. Speeds: direct, 131 and 275 rev. per minute; reverse, 275.

Floor Space. Right angles to spindle, 32". Parallel to spindle, 104".

Weights. Net, about 2800 lbs.; ready for shipment, domestic, about 3390 lbs.; foreign, about 3600 lbs. Dimensions for shipment, 83" x 31" x 34" and 91" x 31" x 33". Space occupied, about 51 cubic feet; about 54 cubic feet.

Equipment. Pump and piping, wrenches and everything else shown in cut, together with overhead works.

Price. F.o.b. Providence, R. I. \$

Longitudinal Hand Feed for Cross Slide for adjustment purposes, \$ extra.

Automatic Transverse Feed for Cross Slide, \$ extra. Tools and Attachments, pages 236 to 275.

No. 0 3-8 in. x 2 1-4 in. WIRE FEED SCREW MACHINE.

- Spindle. Of nickel steel. Bearings hardened, ground and lapped. Phosphor bronze boxes. Front box provided with means of compensation for wear. Thrust taken at rear end of spindle; bearing parts of hardened steel and phosphor bronze. End threaded, 2" diameter, 12, U.S.S., R.H.
 Hole. Through largest feeding finger, 3-8" diameter; through
- Hole. Through largest feeding finger, 3-8" diameter; through feed tube, 13-32"; through spindle without feed tube, 3-4." A feed tube for brass or other light work to 1-2" diameter can be furnished as an extra.
- Drive. Cone, 3 steps, largest, 5 1-4" diameter. 1 1-4" belt. 6 changes of spindle speed direct, 300 to 2000 revolutions per minute in geometrical progression; reverse, 936 to 2000.
- Chuck and Wire Feed. Extremely accurate. One movement of lever feeds any length to 3". Repeated movements of lever give greater length than that for which machine is set. Feed can be operated by cross slide lever. Adjustments fine and readily made. Ordinary variations in size of stock do not affect accurate feeding of machine. Holding capacity of chuck can be made as strong as desired without affecting operation. Scale on feed lever, graduated to 32ds of an inch or to millimetres, facilitates setting machine.
- Turret. 6 holes, 5-8" diameter. Distance, centre of holes to top of slide, 1 1-16"; greatest distance between turret and front of chuck, 7". Stock to 3-8" diameter can be fed through turret. Has gibs for vertical and transverse adjustments to
- turret. Has gibs for vertical and transverse adjustments to compensate for wear. Independent stop for each hole in turret facilitates setting machine.
- **Cross Slide.** Adjustable stops for front and back tools. Tool posts are open on side toward chuck; have fine adjustment for tools.
- Swing. Over cross slide, 3 1-8". Length that can be turned, 2 1-4".

Tank Table. Large reservoir for collecting strained oil.

- Counter-shaft. 3 friction pulleys, 8" diameter. 2 1-2" belts. Speeds: direct, 160 and 500 revolutions per minute; reverse, 500.
- Floor Space. Right angles to spindle, 26 1-2". Parallel to spindle, 43 1-2".
- Weights. Net, about 700 lbs.; ready for shipment, domestic, about 880 lbs.; foreign, about 1025 lbs. Dimensions for shipment, 41"x 20"x 20" and 80"x 23"x 17". Space occupied, about 10 cubic feet; about 20 cubic feet.

Equipment. Pump and piping, 3-8" spring collet and feeding finger, 2 wire stands, wrenches and everything else shown in cut, together with overhead works.

Price. F.o.b. Providence, R. I. \$

An attachment for reversing the spindle can be furnished when desired. It is operated by a pedal, and in many instances its use greatly increases the value of the machine, as both hands of the operator are left free.

Price, \$ extra.

Tools and Sets of Tools, pages 236 to 275.

No. 0

198

3-8 in. x 2 1-4 in.

WIRE FEED SCREW MACHINE.

Patented April 4, 1905.



This machine has a hole 3-8" in diameter through largest feeding finger and turns any length to



This machine has a hole 5-8" in diameter through largest feeding finger and turns any length to 3".

ni 104 annu altar'f in stok hau stool

201

No. 1

5-8 in. x 3 in.

WIRE FEED SCREW MACHINE.

- Spindle. Of nickel steel. Bearings hardened, ground and lapped. Phosphor bronze boxes. Front box provided with means of compensation for wear. Thrust taken at rear end of spindle; bearing parts of hardened steel and phosphor bronze. End threaded, 2 3-4" diameter, 8, U.S.S., R.H.
- Hole. Through largest feeding finger, 5-8" diameter; through feed tube, 21-32"; through spindle without feed tube, 1". A feed tube for brass or other light work to 3-4" diameter can be furnished as an extra.
- Drive. Cone, 3 steps, largest 7" diameter. 1 3-4" belt. 6 changes of spindle speed direct, 150 to 1400 revolutions per minute in geometrical progression; reverse, 573 to 1400.
- Chuck and Wire Feed. Extremely accurate. One movement of lever feeds any length to 4". Repeated movements of lever give greater length than that for which machine is set. Feed operated by lever on front of head stock; can be operated by cross slide lever. Adjustments fine and readily made. Ordinary variations in size of stock do not affect accurate feeding. Holding capacity of chuck can be made as strong as desired without affecting operation. Scale on feed lever facilitates setting machine.
- Turret. 6 holes, 3-4" diameter. Distance, centre of holes to top of slide, 1 1-2"; greatest distance between turret and front of chuck, 9 3-4". Stock to 5-8" diameter can be fed through turret. Has gibs for vertical and transverse adjustments to compensate for wear. Independent stop for each hole in turret facilitates setting machine.
- **Cross Slide.** Adjustable stops for front and back tools. Tool posts are open on side toward chuck, have fine adjustment for tools.
- Swing. Over bed, 10 1-4"; over cross slide, 4 1-8". Length that can be turned, 3".
- Tank Table. Large reservoir for collecting strained oil.
- Counter-shaft. 2 friction pulleys, 10" diameter, 3" belts; 1 friction pulley, 12" diameter, 3 1-2" belt. Speeds: direct, 118 and 450 revolutions per minute; reverse, 450.
- Floor Space. Right angles to spindle, 29"; parallel to spindle, 59".
- Weights. Net, about 980 lbs.; ready for shipment, domestic, about 1200 lbs.; foreign, about 1360 lbs. Dimensions for shipment, 51" x 22" x 22" and 85" x 25" x 18". Space occupied, about 14 cubic feet; about 22 cubic feet.
- Equipment. Pump and piping, 5-8" spring collet and feeding finger, 2 wire stands, wrenches and everything else shown
- in cut, together with overhead works. Price. F.o.b. Providence, R. I. \$

No. 2 7-8 in. x 5 in.

WIRE FEED SCREW MACHINE.

Patented April 4, 1905.



This machine has a hole 7-8" in diameter through largest feeding finger and turns any length to 5".

No. 2

7-8 in. x 5 in.

WIRE FEED SCREW MACHINE.

Spindle. Of crucible steel. Bearings hardened, ground and lapped. Phosphor bronze boxes. Front box provided with means of compensation for wear. Thrust taken at rear end of spindle; bearing parts of hardened steel and phosphor bronze. End threaded, 3 1-2" diameter, 8, U.S.S., R.H.
Hole. Through largest feeding finger, 7-8" diameter; through feed tube, 1 1-32"; through spindle without feed tube, 1 7-16". Regular feed tube takes feeding fingers for brass or other light work to 1" diameter. A feed tube for brass or other light work to 1 1-8" diameter can be furnished as an extra.

- Drive. Cone, 3 steps, largest 9 1-2" diameter. 2 1-2" belt. With 3 speeds of counter-shaft, 6 changes of spindle speed direct, 100 to 1000 revolutions per minute in geometrical progression; reverse, 398 to 1000.
- Chuck and Wire Feed. Extremely accurate. One movement of lever feeds any length to 5". Repeated movements of lever give greater length than that for which machine is set. Feed operated by lever on front of head-stock; can be operated by cross slide lever. Adjustments fine and readily made. Ordinary variations in size of stock do not affect accurate feeding. Holding capacity of chuck may be made as strong as desired without affecting operation. Scale on feed lever facilitates setting machine.
- Turret. 6 holes, 1" diameter. Distance, centre of holes to top of slide, 2 1-8"; greatest distance between turret and front of chuck, 11". Has gibs for vertical and transverse adjustments to compensate for wear. Independent stop for each hole in turret facilitates setting machine.

Turret Slide. Operated by pilot wheel. A lever can be furnished in its place if desired.

Cross Slide. Both rack and screw feed. Change from one to other made by adjustment of clamp screw. Adjustable stops for front and back tools. Tool posts open on side toward chuck; have fine adjustment for tools.

chuck; have fine adjustment for tools. Swing. Over bed, 12 1-2"; over cross-slide, 5". Length that can be turned, 5".

Tank Table. Large reservoir for collecting strained oil.

- Counter-shaft. 2 friction pulleys, 12" diameter, 3 1-2" belts; 1 friction pulley, 14" diameter, 4" belt. Speeds: direct, 100 and 398 revolutions per minute; reverse, 398.
- Floor Space. Right angles to spindle, 33". Parallel to spindle, 68".
- Weights. Net, about 1550 lbs.; ready for shipment, domestic, about 1820 lbs.; foreign, about 2050 lbs. Dimensions for shipment, 65" x 25" x 24" and 95" x 28" x 20". Space occupied, about 23 cubic feet; about 31 cubic feet.
- Equipment. Pump and piping, 7-8" spring collet, feeding finger, wrenches and everything else shown in cut, together with overhead works.

Price. F.o.b. Providence, R. I. \$

Automatic Feed for Turret Slide, \$ extra. For Tools and Attachments, see pages 236 to 275.

202

204 No. 4 1 1-2 in. x 8 in.

WIRE FEED SCREW MACHINE.

Roller Feed.

Patented Jan. 6, 1903; June 6, 1905; Feb. 12, 1907.



organs. Net, about 1330 itsl, ready for shipmont, domestic supposed, 65" x 25" x 24" and 37 x 2x" y 20". Spectrocochilder them 's cube fort' about 31 cubic feet.

This machine has a hole 1 9-16" in diameter Price P. a. D. Frendsburger, J. D. H. Song through spindle and turns any length to 8".

205 No. 4. 11-2 in. x 8 in. WIRE FEED SCREW MACHINE. Roller Feed.

- Spindle. Of crucible steel. Bearings hardened, ground and lapped. Phosphor bronze boxes. Front box provided with means of compensation for wear. Thrust taken at rear end of spindle; bearing parts of hardened steel and phosphor bronze. End threaded, 2 1-2" diameter, 4, U.S.S., R.H. Hole through, 1 9-16". Drive. Cone, 3 steps, largest 11" diameter. 3" belt. Friction
- back gears; operated by lever without stopping machine. 12 changes of spindle speed direct, 35 to 545 revolutions per
- minute in geometrical progression; 6 reverse, 76 to 545. Chuck. Automatic and adjustable. Takes all sizes of stock from 3-8" to 1 1-2" diameter. Takes round, square or hexagonal stock. Automatically compensates for ordinary variations in size of stock. Adjustment easily and quickly made; operates same as universal chuck. Provision for attaching special jaws.
- Roller Feed. In case near back of chuck. Easily and quickly adjusted and operated. Graduations on disk facilitate setting feed to required size of stock. Feeds any length within capacity of machine. All parts most subject to wear are hardened and protected from dirt and injury. Chuck and roller feed operated simultaneously by one lever at front of head-stock.
- Centering Device. Keeps stock in line with spindle; insures firm support. Can be securely clamped after setting.
- Turret. Automatically clamped; 8 holes, 1 3.4" diameter. Distance, centre of holes to top of slide, 3"; greatest distance between turret and front of chuck, 19 3.4". Stock to 1 1-2" diameter can be fed through turret. Special stop can be furnished if desired. Has gibs for vertical and transverse adjustments to compensate for wear. Independent stop for each hole in turret facilitates setting machine. Turret slide bed has positive abutment.
- Feed of Turret Slide. Automatic. 8 changes for each spindle speed in geometrical progression, from .003" to .034" per revolution of spindle. Changes obtained by lever on front
- of head without stopping spindle. Swing. Over bed, 15 1-4"; over cross slide, 7 3-4". Length that can be turned, 8".
- Cross Slide. Adjustable stops for front and back tools. Dials read to .0005" to show setting. Tool posts open on side toward chuck; have fine adjustment for tools.

- Tank Table. Large reservoir for collecting strained oil.
 Counter-shaft. 3 friction pulleys, 14" diameter. 4" belts.
 Speeds: direct, 157 and 333 rev. per minute; reverse, 333.
 Floor Space. Parallel to spindle, 90". At right angles, 30".
 Weights. Net, about 2450 lbs.; ready for shipment, domestic,
- about 2900 lbs.; foreign, about 3200 lbs. Dimensions for shipment, 75" x 31" x 30" and 95" x 32" x 22". Space occupied, about 40 cubic feet; about 39 cubic feet.
- Equipment. Pump and piping, chuck, wrenches and everything else shown in cut, together with overhead works.
- Price. F.o.b. Providence, R. I. \$
- Longitudinal Hand Feed for Cross Slide for adjustment purposes, \$ extra.

Automatic Transverse Feed for Cross Slide, \$ Tools and Attachments, pages 236 to 275.

extra.

No. 6 1 1-2 in. x 10 in.

WIRE FEED SCREW MACHINE.

Roller Feed.

independent Chards. Provision for all highly



This machine has a hole 2 1-16" in diameter through spindle and turns any length to 10".

No. 6 1 1-2 in. x 10 in. WIRE FEED SCREW MACHINE. Roller Feed.

207

- Spindle. Of crucible steel. Bearings hardened, ground and lapped. Phosphor bronze boxes. Front box provided with means of compensation for wear. Thrust taken at rear end of spindle; bearing parts of hardened steel and phosphor bronze. End threaded, 3" diameter, 3 1-2, U.S.S., R.H.
- bronze. End threaded, 3" diameter, 3 1-2, U.S.S., R.H. Hole through, 2 1-16" diameter.
 Drive. Cone, 3 steps, largest 11" diameter. 3" belt. Friction back gears operated by lever without stopping machine. 12 changes of spindle speed direct, 30 to 450 revolutions per minute in geometrical progression; 6 reverse, 63 to 450.
 Chuck. Automatic and adjustable. Takes all sizes of stock for the 9" direct the 9" dir
- from 1-2" to 2" diameter: 1 1-2" to 2" ordinary duty; 1-2" to 1 1-2" heavy duty. Takes round, square or hexagonal stock. Automatically compensates for ordinary variations in size of stock. Adjustments easily and quickly made; adjusts same as universal chuck. Provision for attaching special jaws. A collet chuck can be furnished as an extra.
- Roller Feed. In case near back of chuck. Graduations on disk facilitate setting feed to required size of stock. Feeds any length within capacity of machine. All parts most subject to wear hardened, protected from dirt and injury. Chuck and feed operated simultaneously by one lever at front. Centering Guide. Keeps stock in line with spindle; insures firm
- support. Can be securely clamped in position after setting. Turret. 7 holes, 2" diameter. Automatically clamped. Dis-tance from centre of holes to top of slide, 3 5-8"; greatest distance between turret and front of chuck, 25". Flat surfaces for clamping special tools. Has gibs for vertical and transverse adjustments to compensate for wear. Each hole in turret has independent stop with screw adjustment. Turret slide bed has positive abutment.
- Feed of Turret Slide. Automatic. 8 changes for each spindle speed, in geometrical progression, .003" to .034" per revolu-tion of spindle. Changes obtained by lever on front of head without stopping spindle.
- Swing. Over bed, 18"; over cross slide, 8 3-4". Length that can be turned, 10".
- Cross Slide. Adjustable stops for front and back tools. Dials read to .0005" to show setting. Tool posts open on side toward chuck; have fine adjustment for tools.
- Tank Table. Large reservoir for collecting strained oil. Counter-shaft. 3 friction pulleys, 14" diameter. 4" belts.
- Speeds: direct, 131 and 275 rev. per minute; reverse, 275.
 Floor Space. Parallel to spindle, 104"; at right angles, 32".
 Weights. Net, about 3000 lbs.; ready for shipment domestic, about 3600 lbs.; foreign, about 3890 lbs. Dimensions for shipment, 83" x 31" x 34" and 91" x 31" x 33". Space occupied, about 51 online for the online fort. about 51 cubic feet; about 54 cubic feet.
- Equipment. Pump and piping, chuck, wrenches and every-thing else shown in cut, together with overhead works.
- Price. F.o.b. Providence, R. I. \$
- Longitudinal Hand Feed for Cross Slide for adjustment purposes, \$ extra. Automatic Transverse Feed for Cross Slide, \$
 - extra.
- Collet Chuck, \$ extra. Tools and Attachments, pages 236 to 275.



This machine has a hole 5-16" in chameter through largest feeding finger and turns any length to 1 1-4" and any length to 2" can be fed. 209

No. 00

5-16 in. x 1 1-4 in.

AUTOMATIC SCREW MACHINE.

- Spindle. Of nickel steel. Bearings hardened, ground and lapped. Phosphor bronze boxes. Front box provided with means of compensation for wear. Thrust taken at rear end of spindle; bearing parts of hardened steel and phosphor bronze.
- Drive. 2 friction clutch pulleys, 4" diameter. 1 1-4" belts. Bushed with steel. Roller bearings. 12 changes of spindle speed in geometrical progression, 420 to 2400 revolutions per minute.
- Hole. Through largest feeding finger, 5-16" diameter; through feed tube, 21-64". A feed tube for brass or other light work to 3-8" diameter can be furnished as an extra.
- Collets. Easily changed. Adjusted by nuts at rear end of spindle.
- Turret. 6 holes, 5-8" diameter. Revolves vertically on side of turret slide. Greatest distance, front of chuck to turret, 3"; least, 1 5-8". Tools turn any length to 1 1-4".
- Movements. Indexing of turret, operation of chuck, feeding of stock, and reversal of spindle, controlled by adjustable dogs, easy of access and quickly adjusted. Feed of turret slide and cross slides controlled by cams, made from steel disks, cheaply formed and easily adjusted. Return and change movements extremely rapid.
- Feeding Mechanism. Extremely rapid. Feeds any length to 2"; using 1 hole in turret to receive stock, 4". Can be stopped independent of spindle. Adjustment fine and readily made. Scale on feed slide, graduated to 32nds of an inch or to millimetres, facilitates setting machine.
- Cross Slide Tools. On separate slides. Can be operated together or separately. Tool posts have fine adjustment. Turret slide and cross slide tools may be operated by hand.
- Automatic Stop. For feeding mechanism; operates when stock is exhausted. Leaves chuck open.
- Change Gears. Provide for making from 40 to 1200 pieces per hour.
- Counter-shaft. 1 pair of tight and loose pulleys, 8" diameter. 3" belt. Speed: 450 revolutions per minute.
- Floor Space. Right angles to spindle, 22". Parallel to spindle, 40".
- Weights. Net, about 1050 lbs.; ready for shipment, domestic, about 1300 lbs.; foreign, about 1370 lbs. Dimensions for shipment, 44" x 20" x 25" and 74" x 26" x 20". Space occupied, about 13 cubic feet; about 22 cubic feet.
- Equipment. Pump and piping, 5-16" spring collet and feeding finger, set of cam blanks, change gears, 2 wire stands and everything else shown in cut, together with overhead works. Instructions and diagrams for laying out cams sent with each machine.
- Price. F.o.b. Providence, R. I. \$

No. 00G

5-16 in. x 1 1-4 in.

AUTOMATIC SCREW MACHINE.

Constant Speed Drive.

Patented April 11, 1899; April 4, 1905; July 11, 1911.



This machine has a hole 5-16" in diameter through largest feeding finger and turns any length to 1 1-4" and any length to 2" can be fed.

211

No. 00G

5-16 in. x 1 1-4 in. AUTOMATIC SCREW MACHINE.

- **Spindle.** Of nickel steel. Bearings hardened, ground and lapped. Phosphor bronze boxes. Front box provided with means of compensation for wear. Thrust taken at rear end of spindle; bearing parts of hardened steel and phosphor bronze.
- Drive. 1 friction clutch pulley, 8" diameter. 2 1-2" belt. Runs at constant speed 350 revolutions per minute. 15 changes of spindle speed, in geometrical progression, 260 to 2420 revolutions per minute. Changes made by the adjustment of change gears and automatically operated friction clutch. 2 speeds in each setting automatically obtained in a ratio of about 2 1-2: 1.
- Hole. Through largest feeding finger, 5-16" diameter; through feed tube, 21-64". A feed tube for brass or other light work to 3-8" diameter can be furnished as an extra.
- **Collets.** Easily changed. Adjusted by nuts at rear end of spindle.
- Turret. 6 holes, 5-8" diameter. Revolves vertically on side of turret slide. Greatest distance, front of chuck to turret, 3"; least, 1 5-8". Tools turn any length to 1 1-4".
- Movements. Indexing of turret, operation of chuck, feeding of stock, and reversal of spindle, controlled by adjustable dogs, easy of access and quickly adjusted. Feed of turret slide and cross slides controlled by cams, made from steel disks, cheaply formed and easily adjusted. Return and change movements extremely rapid.
- Feeding Mechanism. Extremely rapid. Feeds any length to 2"; using 1 hole in turret to receive stock, 4". Can be stopped independent of spindle. Adjustment fine and easily made. Scale on feed slide, graduated to 32ds of an inch or to millimetres, facilitates setting machine.

Cross Slide Tools. On separate slides. Can be operated together or separately. Tool posts have fine adjustment. Turret slide and cross slide tools may be operated by hand.

Automatic Stop. For feeding mechanism; operates when stock is exhausted. Leaves chuck open.

- Change Gears. Provide for making from 40 to 1200 pieces per hour.
- Floor Space. Right angles to spindle, 23". Parallel to spindle, 49".
- Weights. Net, about 1350 lbs.; ready for shipment, domestic, about 1700 lbs.; foreign, about 1700 lbs. Dimensions for shipment, 44"x 20"x 23" and 53"x 27"x 45". Space occupied, about 12 cubic feet; about 37 cubic feet.
- Equipment. Pump and piping, 5-16" spring collet and feeding finger, set of cam blanks, change gears, 2 wire stands and everything else shown in cut. Instructions and diagrams for laying out cams sent with each machine.

Price. F.o.b. Providence, R.I. \$ Counter-shaft, \$ extra.

Equipped with motor, price on application.

212 No. 0 1-2 in. x 2 in. AUTOMATIC SCREW MACHINE Patented April 11, 1899; April 4, Dec. 12, 1905.

This machine has a hole 1-2" in diameter through largest feeding finger and turns any length to 2" and any length to 3" can be fed.

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213

No. 0

1-2 in. x 2 in.

AUTOMATIC SCREW MACHINE.

- Spindle. Of nickel steel. Bearings hardened, ground and lapped. Phosphor bronze boxes. Front box provided with means of compensation for wear. Thrust taken at rear end of spindle; bearing parts of hardened steel and phosphor bronze.
- Drive. 2 friction clutch pulleys, 6" diameter. 2" belts. Bushed with steel. Roller bearings. 12 changes of spindle speed in geometrical progression, 200 to 1800 revolutions per minute. 2 speeds in each setting automatically obtained in ratio of 2:1.
- Hole. Through largest feeding finger, 1-2" diameter; through feed tube, 17-32". A feed tube for brass or other light work to 5-8" diameter can be furnished as an extra.
- Collets. Easily changed. Adjusted by nuts at rear end of spindle.
- Turret. 6 holes, 3-4" diameter. Revolves vertically on side of turret slide. Greatest distance, front of chuck to turret, 51-8"; least, 21-4". Tools turn any length to 2".
- Movements. Indexing of turret, operation of chuck, feeding of stock and reversal of spindle controlled by adjustable dogs, easy of access and quickly adjusted. Feed of cross slides and turret slide controlled by cams, made from steel disks, cheaply formed and easily adjusted. Return and change movements extremely rapid.
- Feeding Mechanism. Extremely rapid. Feeds any length to 3"; using 1 hole in turret to receive stock, 6". Can be stopped independent of spindle. Adjustment fine and easily made. Scale on feed slide, graduated to 32ds of an inch or to millimetres, facilitates setting machine.

Cross-Slide Tools. On separate slides. Can be operated together or separately. Tool posts have fine adjustment. Turret slide and cross slide tools may be operated by hand.

Automatic Stop. For feeding mechanism; operates when stock is exhausted. Leaves chuck open.

Change Gears. Provide for making from 10 to 720 pieces per hour.

Counter-shaft. 2 friction, 2 loose pulleys, 10" diameter. 3 1-4" belts. Speeds: 170 and 377 revolutions per minute.

Floor Space. Right angles to spindle, 23". Parallel to spindle, 51".

Weights. Net, about 1630 lbs.; ready for shipment, domestic, about 2110 lbs.; foreign, about 2150 lbs. Dimensions for shipment, 53"x25"x27" and 81"x 27"x25". Space occupied, about 21 cubic feet; about 32 cubic feet.

Equipment. Pump and piping, 1-2" spring collet and feeding finger, set of cam blanks, change gears, 2 wire stands and everything else shown in cut, together with overhead works. Instructions and diagrams for laying out cams sent with each machine.

Price. F.o.b. Providence, R. I. \$