Milling Machines

THE
R·K·LeBLOND
MACHINE TOOL
CO.

Cincinnati-Ohio
U.S.A.

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ILLUSTRATED CATALOG

of

"LE BLOND"

MILLING MACHINES

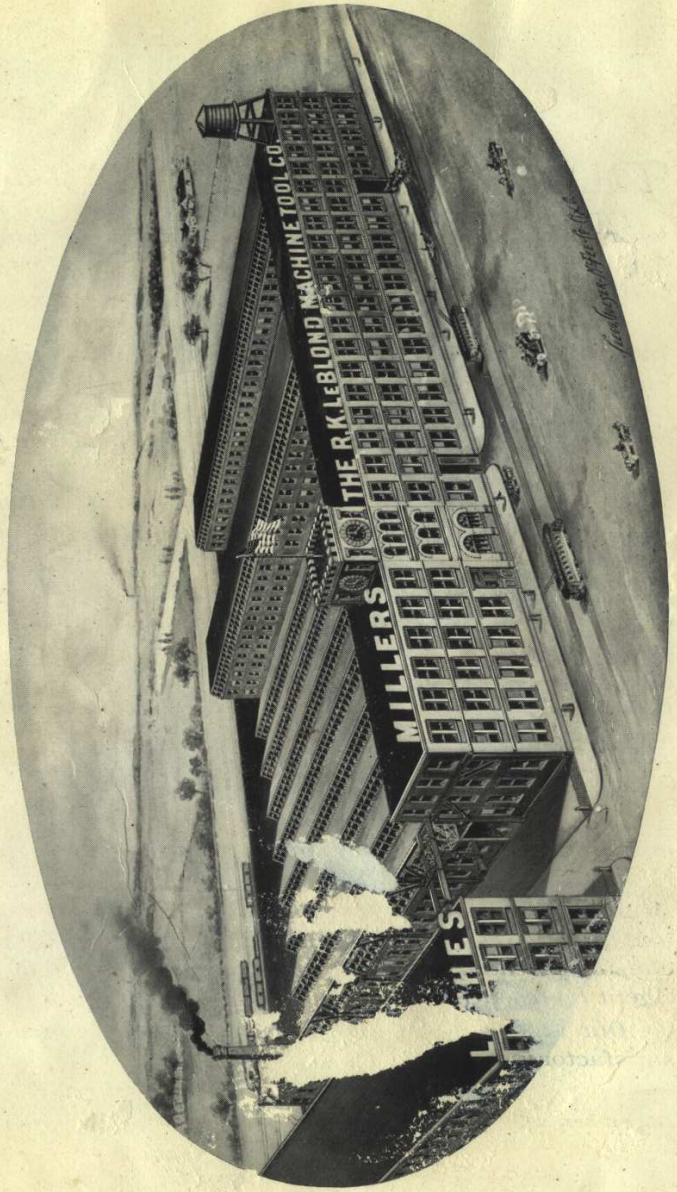
AND

ATTACHMENTS

Manufactured by

The R. K. LeBlond Machine Tool Co.

CINCINNATI, O., U. S. A.



TO THE TRADE.

THE business now conducted by THE R. K. LEBLOND MACHINE TOOL CO., was established in 1887 and incorporated in 1898. Our location on the main line of the Pennsylvania, with our own siding, gives us the best shipping facilities.

Our BUILDINGS were designed specially for Machine Tool Manufacture. They have a frontage of 360 ft. giving a total floor space of 100,000 square feet. The first floor is built of stone, the balance of brick. The roof of the one-story section being of saw-tooth construction, we have all the natural light desired.

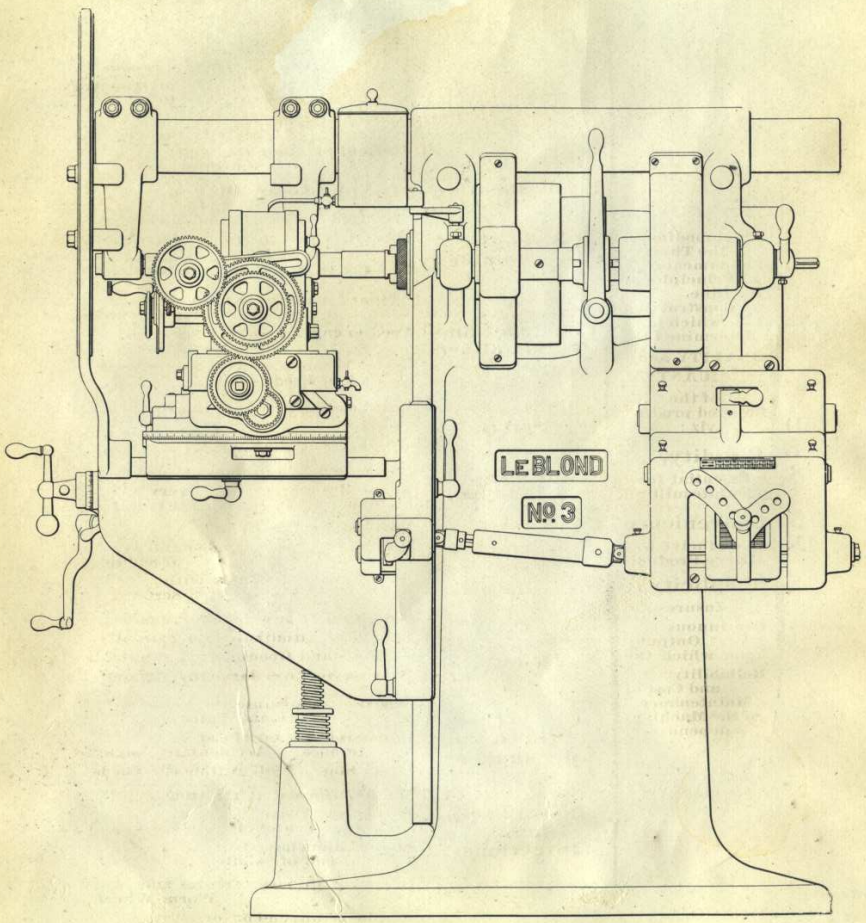
Our EQUIPMENT is modern and the best that can be obtained. Special machines, tools and fixtures are employed, insuring a high standard of excellence and exact duplication of parts.

Our TOOLS: we make a specialty of Milling Machines and Lathes. Each line is built in a special department devoted exclusively to that purpose. All our efforts are concentrated to make our tools the best of their kind, and improvements and betterments are continually being made to maintain this standard. We ask a careful comparison of our tools with those of any make. Visitors and prospective buyers are urged to visit our shops and prove to their satisf[illegible] our claims of superiority.

Our GOODS are han[illegible]ed by Agents all over the world. As most of them buy i[illegible]load lots, a saving of Freight and quicker delivery can generally be obtained by purchasing of them. We will gladly give the name of the [illegible]ting us in your territory.

[illegible]MS. [illegible]rs Net Cash where credit is satis[illegible]y.

November, 1908.



Salient Features of the "LeBlond" New Design Millers.

DESIGN — An embodiment of the Three Fundamental Principles of Machine Construction which determine the QUALITY and QUANTITY of the finished product viz:

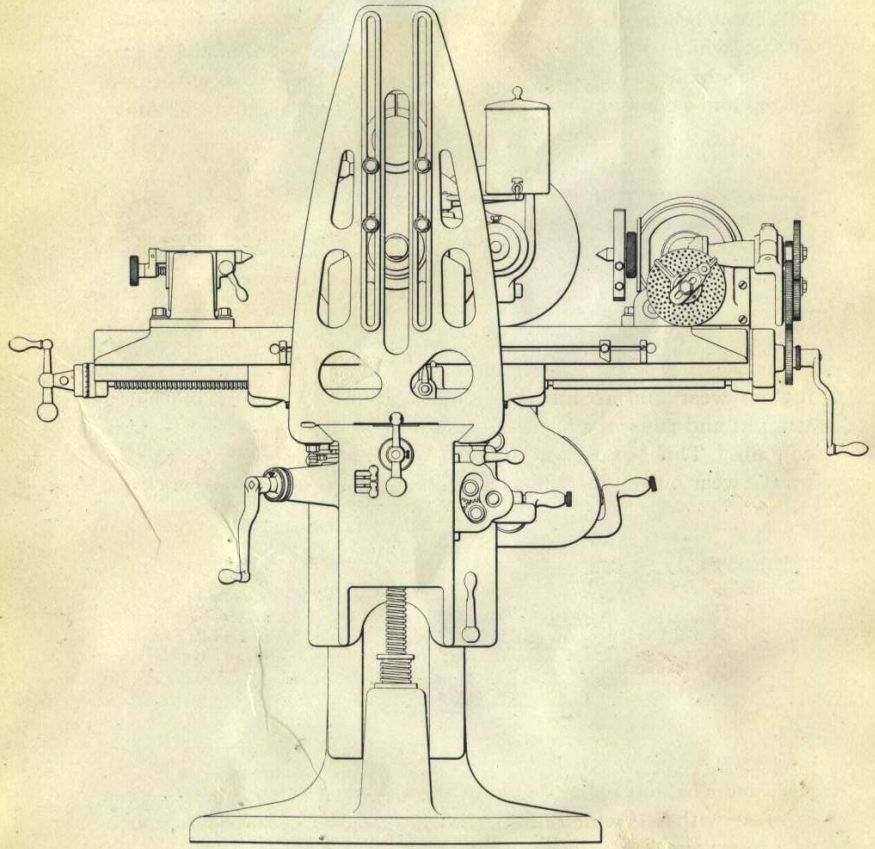
- **Rigidity,** Essential for accurate milling
- **Convenience** Conducive to Large Product
- **Simplicity** Insures Continuous Output upon which the Reliability and Cost of Maintenance of the Machine depend

Drive—Patent Double Friction Back Gears

- **Powerful**
  - Three-Step Cone of Maximum Diameter
  - Small Drop to Steps for Wide Belt
  - High Belt Speeds give Increased Power
- **Adequate**
  - Eighteen Spindle Speeds in Geometric Progression
  - Four Spindle Speeds without Stopping or Shifting a Belt
  - High or Low Back Gears instantly engaged
  - Efficient for Roughing and Finishing Cuts

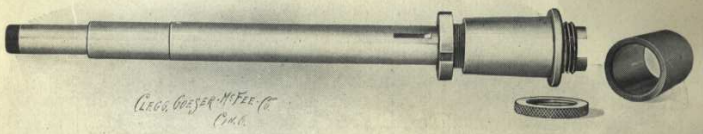
Feed—Positive All-Spur-Gear Driven

- **Strength Doubled**
  - Gearing Coarse Pitch and Made of Steel
  - Capacity equal to Spindle Drive
  - Feed Screws of Large Diameters Coarse Pitch and Double Lead
- **Construction Simplified**
  - Absence of Bevel Gears and Sliding Clutches
  - Feed engaged and reversed by a Single Lever
  - No Gears running with Feed Screw when Feed is out
- **Spindle**
  - Hardened and Ground Journals
  - Clutch Drive to Arbor
  - Draw-in Bolt for Arbor
- **Arbor Support**
  - Two Independent Supports used
  - Arbor Brace—new form—very stiff made in one continuous piece
- **Table**
  - Unusually Great Depth
  - Bearing surface extended full width of Saddle
  - Rapid Return to Table with Double Pitch Screw
- **Knee**
  - New form of Box Construction
  - Braced longitudinally and laterally
  - All Slots and Openings are eliminated
  - Bearing Surfaces large throughout
- **Feed Mechanism**
  - Feed Levers operate in Horizontal Plane
  - Impossible for any Feed to become Accidentally Engaged
  - Safety Stops on all Automatic Feeds
- **Power Feed in all Directions**
  - Can be attached at any time
  - Bevel Gear Drive Through Center of Saddle abandoned
  - Plain Millers have Direct Spur Drive at end of Saddle
- **Dividing Head**
  - Improved Precision Worm and Worm Wheel
  - Ample Arrangement for Perfect Adjustment
  - All Gearing on outside of Head Completely Covered at all times
- **Countershaft**
  - New Design Double Friction Rim Type
  - Self-Oiling Hangers and Pulleys
  - Size of Pulleys and Shaft ample for Heavy Service

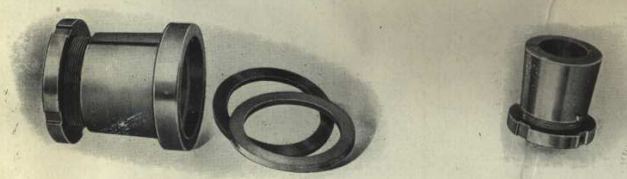


GENERAL DESCRIPTION.

SPINDLE AND BEARINGS. The Spindles are unusually heavy. The front bearing is tapering and has a hardened steel bush pressed over it, which runs in a box made of special cast iron. With a hard spindle which it is impossible to cut or scratch, the box soon becomes glazed and a combination is secured that will run indefinitely, show-



ing no wear and requiring little attention. The rear journal is straight and runs in a bronze box which is fitted to a taper hole in column. This box is split and can be drawn into the taper to take up the wear on the rear journal. The thrust is taken by a hardened



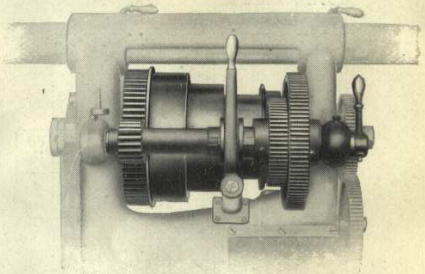
steel and a babbitt collar. An oil slot is milled in both boxes, then is filled with felt which filters the oil—a recess in the column acts as a reservoir.

ARBOR DRIVE. The Arbor is driven by a clutch milled in the



spindle nose. The end of the arbor is tapped out to receive a long bolt that passes through the spindle. With this bolt the arbor is drawn into the taper and also forced out when required. The bolt has a "square" milled on the outer end to fit the table crank handle.

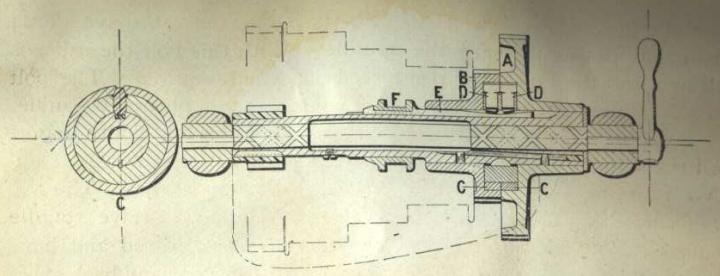
CONE. The Cones are large and have ample belt width to give all the spindle power required for high speed steel. The No. 0 and No. 1 are not back-geared and have eight spindle speeds. The No. 1½ and No. 2 are single back-geared and have twelve spindle speeds. The Nos. 2½, 3 and 4 are double back-geared and have eighteen spindle speeds. The proportion of the cone and back gears is arranged to give spindle speeds in geometric progression. An engraved speed plate on the machine indicates the various speeds obtainable; also gives the surface speeds in feet per minute, for various diameters of cutters at 40, 50 and 60 feet. These figures can be doubled for 80, 100 and 120 feet, or halved for 20, 25 and 30 feet. In this manner the correct spindle speed for surface speeds from 20 to 120 feet is readily determined. The machines with the plain cone drive are arranged to give the coarse change of speed with the countershaft, which gives much better cone proportions and also a quick change of speed for roughing and finishing cuts. The single back-gear drive is familiar and well understood.



THE LEBLOND PATENT DOUBLE FRICTION BACK GEARS have special advantages over any other form of back-gear arrangement:

1st. The cone can be better proportioned.
2d. Higher belt speed and better belt contact.
3d. A greater number of spindle speeds are obtainable.
4th. Allow four changes of speed without shifting a belt.
5th. Permit the use of a high back-gear ratio.
6th. Drive twice as powerful as single geared machine.

The construction is shown on next page: the rings (C, C,) are expanded into either gear (A or B) by means of a double tapered key (E) and the taper plugs (D, D.) This friction is automatic in its adjustment and any driving tension can be obtained by forcing the key harder against the plugs. This friction, being on the back-gear quill, the power is multiplied three times before it reaches the cutter. It can be so thrown in that it will but just turn over the



spindle, while with a harder pressure it will drive the full capacity of the gears. The machine can be started and stopped with the friction lever, and in connection with the double friction countershaft gives four changes of speed without shifting a belt. This is found to be very convenient in roughing and finishing work, as the proper speed can be selected for one, with the option of three, speeds for the other without shifting a belt.

Table of Spindle Speeds.

Double Back Gear

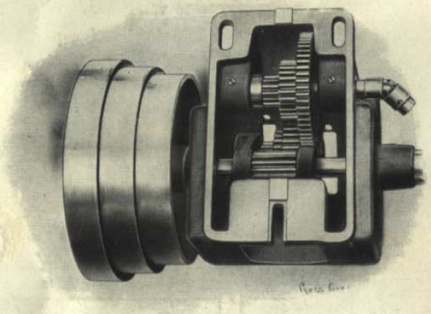
Drive	Spindle Speed	Cutter Diam. for Surface Speed of 40 Ft.	50 Ft.	60 Ft.
With 2nd B Gr.				
D-6	18	8 1/16	10 3/8	12 3/4
E-6	21	7 1/4	9 1/8	10 7/8
D-B	25	6 1/8	7 7/8	9 1/8
E-B	31	4 7/8	6 1/8	7 3/8
D-A	38	4	5	6
E-A	44	3 1/16	4 1/8	5 1/4
Without 2nd B Gr.				
D-6	52	3	3 7/8	4 1/4
E-6	62	2 1/2	3 1/16	3 7/16
D-B	74	2 1/16	2 5/8	3
E-B	89	1 3/4	2 1/16	2 1/2
D-A	107	1 7/16	1 3/4	2 1/16
E-A	127	1 3/16	1 1/2	1 3/4
Without B Gr.				
D-6	158.4	1	1 1/4	1 7/16
E-6	189.3	7/8	1	1 3/16
D-B	227	7/16	7/8	1
E-B	271.5	5/16	11/16	13/16
D-A	328	7/16	9/16	11/16
E-A	392	3/8	1/2	9/16

Single Back Gear

Drive	Spindle Speed	Cutter Diam. for Surface Speeds of 40 Ft.	50 Ft.	60 Ft.
With Back Gr.				
D-6	18	8 1/16	10 3/8	12 3/4
E-6	25	6 1/16	7 5/8	9
D-B	32	4 3/4	6	7
E-B	43	3 1/2	4 3/8	5 1/4
D-A	58	2 5/8	3 1/4	4
E-A	78	1 7/8	2 1/2	3
Without B Gr.				
D-6	117	1 3/8	1 5/8	2
E-6	159	1	1 1/4	1 1/2
D-B	207	3/4	7/8	1
E-B	280	1/2	5/8	3/4
D-A	370	7/16	1/2	5/8
E-A	500	3/8	7/16	1/2

Above are given comparative tables showing the relative value of the single and double back-gear drive. These tables give spindle speeds and proper size cutters for cast iron and steel, and show some

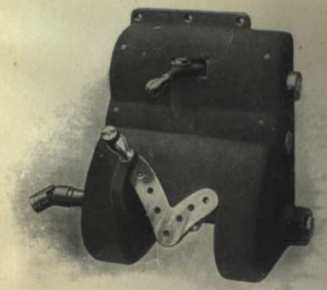
few advantages of the double friction back-gears. They increase the spindle speeds of the machine 50 per cent, thereby giving eighteen spindle speeds; the increased speeds are in smaller increments, allowing the operator to obtain the correct cutting speed for almost any size cutter. It will also be noted on the single back-gear machine, that the speeds most frequently used are with open belt, while with the double back-gears these would be taken with the low gear engaged, giving a much more powerful drive.



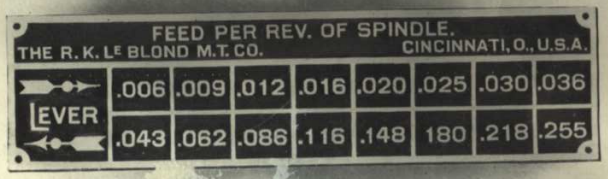
THE FEED BOX on the Nos. 0, 1 and [illegible] belt driven. The feed belts will easily drive any feed of [illegible] the machine is capable, as the feed cones are proportioned to [illegible] power of the machine. On these machines the feed [illegible]nes are five-sixths the diameter and five-twelfths the face of the driving cone. On the back-geared machines they are the same diameter as the main driving cone and one-half the face. By this method of feed the highest efficiency is obtained on a small machine, dispensing with a number of shafts, gears, and a lot of friction, which means a saving of a large per cent of the driving power. **We use the power for driving the Cutter.** The feed cones are adjustable, therefore belts can be made endless and kept at the proper tension.

By the use of the belt driven feed box fifteen changes of feed are obtainable, the changes being made with belt and lever. In actual use the lever covers 90 per cent of the required changes and gives a wide range of feeds.

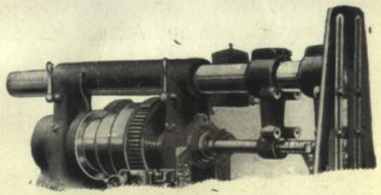
On the Nos. 2, 2½, 3 and 4 machines the feed box is driven with spur gears, doing away with all bevels, spirals, chains and

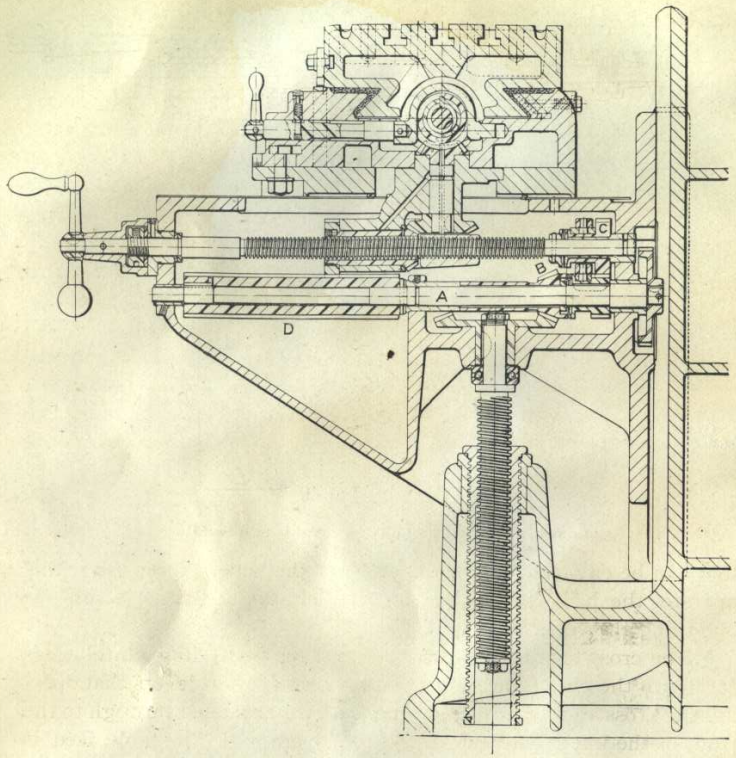


belts, and giving the highest efficiency possible from a positively driven feed. With this box 16 changes of feed are obtainable for each spindle speed, one lever practically controlling all the changes. If the extreme range is required the top lever is shifted. There are no pins to pull or other boxes to take care of. It is self-contained, giving the entire range of feeds. All changes can be made under a cut without stopping machine. The handles are entirely separate and do not have to be worked together. For example—suppose we have a feed of .006 and wanted .020, simply move the lower lever to the fifth hole. If a feed of .043 is wanted, shift the top lever.



ARBOR SUPPORT AND BRACE. The overhanging arm is made from a solid bar of steel. It is clamped in any position to the column by fixed handles. Two arbor supports are furnished, one of these has a taper bronze bush for receiving the end of the arbor, the other is bushed to a large diameter to support the arbor in the middle or wherever the cutter will permit. Both these supports have four lugs cast on them so that either one can be bolted to the knee brace. The knee brace is of improved construction; it is



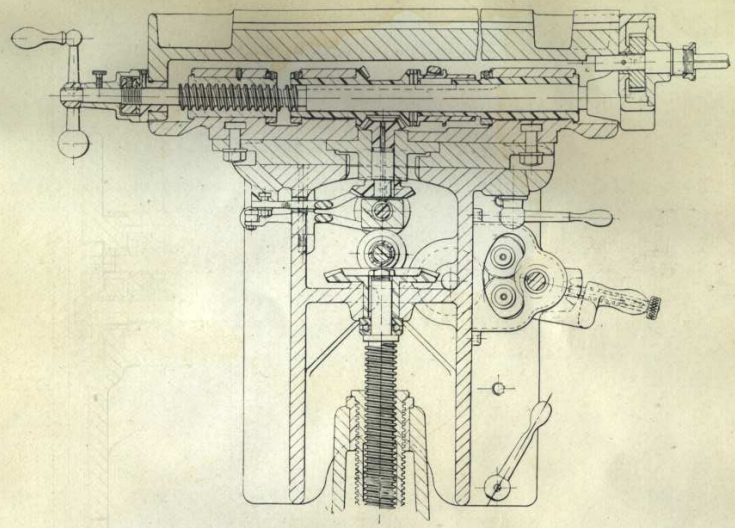


Transverse Section of Knee, Table and Saddle.

made in one piece that insures the greatest rigidity. The brace is made with an offset, and can be reversed so as to secure the maximum cross movement with any length of arbor.

ARBOR LENGTHS. For work that will permit a short arbor, the middle arm can be turned up out of the way, and the end of the arbor supported by the outer support and the brace. However a long arbor can be used just as well and be as rigid. The outer support should be taken off, and the inner support set as close to the cutter as possible and the knee brace connected to it.

UNIVERSAL FEED MECHANISM IN SADDLE AND KNEE is new. It is powerfully geared and steel gears are employed throughout. The feed is reversed with tumbler gears on the side of the knee, and transmitted through a wide face intermediate gear to the sleeve gear shaft (**A**). This shaft has keyed to it a sliding clutch,

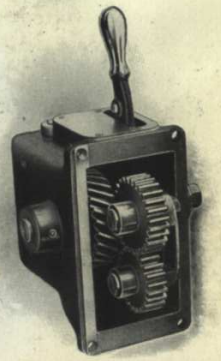


Longitudinal Section of Knee, Table and Saddle.

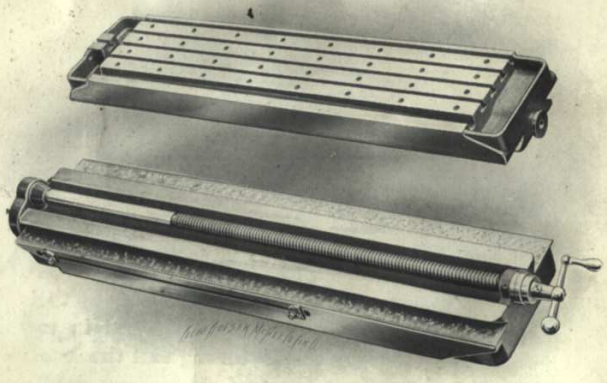
that can be engaged with the clutch on the bevel pinion (**B**), this operates the large bevel gear on the vertical telescopic screw for obtaining the vertical feed.

The cross feed is obtained by engaging the sliding clutch gear (**C**) with the clutch on the cross feed screw. The levers that operate the cross and vertical feed clutches, are extended through to the front of the knee, convenient for the operator. The table feed is driven through the long sleeve gear (**D**), through the gear revolving on the cross feed bearing, (the cross feed screw passes through this gear but does not touch it,) then through the vertical bevel shaft, to the gear that drives the table screw in the saddle. This construction permits the cross feed screw to be placed in the middle of the knee and eliminates all twisting strains, since the power is applied at the neutral axis, which prevents binding of the bearings and gives absolute free and smooth movement to the slide. There are permanent stops for tripping the feed at the end of their movements. The feeding mechanism has been worked in to allow a series of lateral and transverse ribs throughout the knee, and to eliminate all slots and openings except for the cross feed nut and this is made of the smallest permissable area, and is covered by sliding covers to protect the working parts from chips, doing away with the "bureau drawer" effect of a screw set at the side. The vertical screw is telescopic and has ball thrust bearings.

FEED REVERSE AND TRIP BOX. On the Plain and All Feeds Plain Machines, the table feed is driven with direct spur gear drive on the end of saddle. By this method a more efficient and powerful drive is obtained than can be had with the usual construction, viz: of coming through the center of the knee and saddle. The feed is engaged and reversed by a single lever, depressing the lever, feeds the table to the right, elevating it, feeds the table to the left.



TRIPS ACCURATELY. On such work as end milling and T-slotting the advantages of this construction are apparent. It saves the loss of time as well as mistakes made, by the use of the two levers. The trip is accurate and will trip to a line under any cut. When the feed is tripped there are no gears or clutches working idly on the screw or in the saddle. The spur gears that engage with the screw gear in the saddle are driven by hobbed spiral gears and are cut at an angle that gives the highest efficiency. The thrust of the gears is taken against ball bearings. One box serves both purposes and there are few working parts.



THE TABLES are very heavy and deep and the working surfaces are exceptionally wide. The bearing is taken on the outside of the dovetail and extends the full width of the table. It is oiled by means

of felt oil pads. In the oil pocket at the end of the table a bearing is located to receive the dividing head; this also adds 4½ inches to the working surface of the table when using the head. Large oil pockets extend entirely around the table and the oil is drained to either end, from which it can be drawn off through pet cocks provided for that purpose.

The table feed screw is made with coarse pitch and of unusually large diameter to give a smooth feed to table when taking heavy cuts. On the No. 3 machine it is 1¾-inch diameter, and two-fifths lead. The screw is geared to return the table eight-tenths of an inch per revolution of return crank. The thrust is taken at the ends of table against ball bearings, and the screw is therefore always maintained under tension, regardless in which direction the table is being fed.

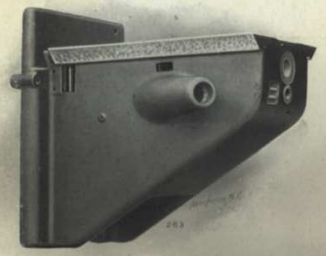


Fig. 1

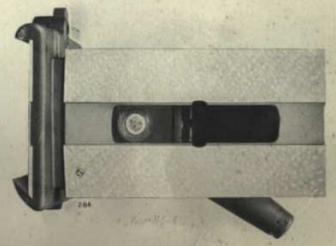


Fig. 2

THE KNEE is made in box section, ribbed and braced transversely and laterally.

Fig. 1 is a side view of the knee, showing the extended column bearing which extends nearly to the top of the table, increasing its length and giving a rigid support close to the table, and at a point where it is most needed to resist deflection of the knee.

Fig. 2 is a top view, showing the wide saddle dovetail, which in our millers is much wider than that on the column, gives a support well towards the ends of the saddle. The generous bearing surface is also clearly shown. The cross feed screw is set in the center of the knee, doing away with all side strain, making a free and easy movement; the nut opening, as will be seen, has been reduced to the least possible dimensions, and is the only opening cast in the knee. This opening is closed by sliding covers dovetailed into the slide, and feed works are protected from chips and dirt at all times.

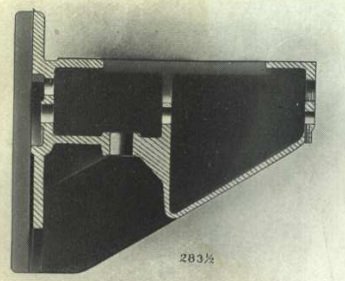


Fig. 3

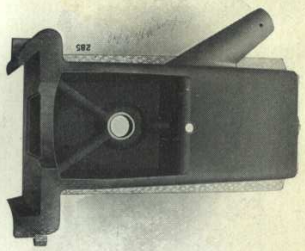
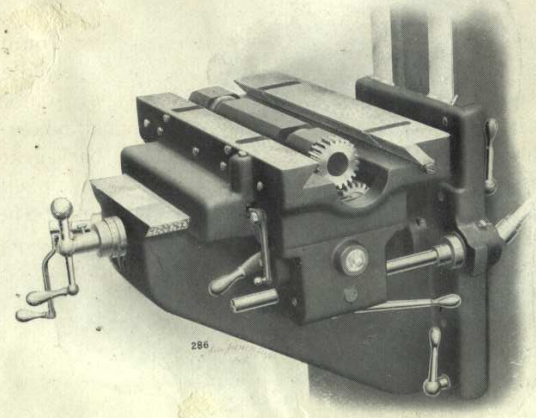


Fig. 4

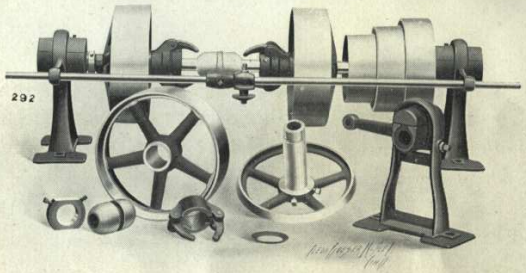
Fig. 3 is a transverse section through the center of the knee, and shows the method of bracing, which divides the knee into a series of compartments or boxes, which give the greatest rigidity to resist distortion in any direction.

Fig. 4 is a view of the underside of knee and shows the bracing which effectively resists the thrust of the vertical feed screw and prevents chattering when taking a heavy cut with the vertical feed.



THE SADDLE is of massive proportions. This is made possible by the simple feed mechanism; to give additional rigidity the saddle is braced its entire length by arched ribbing, through which the

table screw passes. The taper gib for the long table bearing is made with a tongue to resist any tendency to lift. The lower gib is made with two angles and held by fine threaded cap screws, fitted very tightly on the thread. All wear is compensated for by adjusting these screws and drawing in the gib. Fixed handles are on all locking screws on both knee and saddle, and draw the gib in like a wedge, bringing the two surfaces together, metal to metal. The two parts of the saddle on the Universal machine are clamped together by three T-slot bolts in a single T-slot near the outside of the swivel. The large diameter of the swivel is graduated to half degrees.



COUNTERSHAFT. A two-speed, double friction Countershaft is furnished. The shafts are very heavy and the large pulleys give great belt surface. The frictions are of the rim type. The har
of double brace type and have self oiling journal boxes. The small machines use a hub friction; for the double back-geared machine a rim friction is furnished. The pulleys run on self-oiling bushes; can be oiled without stopping or throwing off the belt, and not being dependent on pins or oil connections, can be placed in any position on the shaft. Both belts should run forward.

"LeBlond" Plain Milling Machines.

The Plain Milling Machine is pre-eminently a manufacturing machine. On this type of machine there is no swiveling movement to the table, which is held rigidly at right angles to the spindle and is supported by a long bearing directly under the knee. The simplicity of this construction insures a more rigid machine and the feeding mechanism can be made more simple and powerful.

For Spiral work it is not necessary to have a Universal machine as spirals can be cut on the Plain machine, and in many cases to better advantage, when equipped with the attachments shown on pages 90 and 91. In our shop, where we have both Plain and Universal Milling Machines at our disposal, we invariably cut our spiral gears on a Plain Miller with the Attachment shown on page 91.

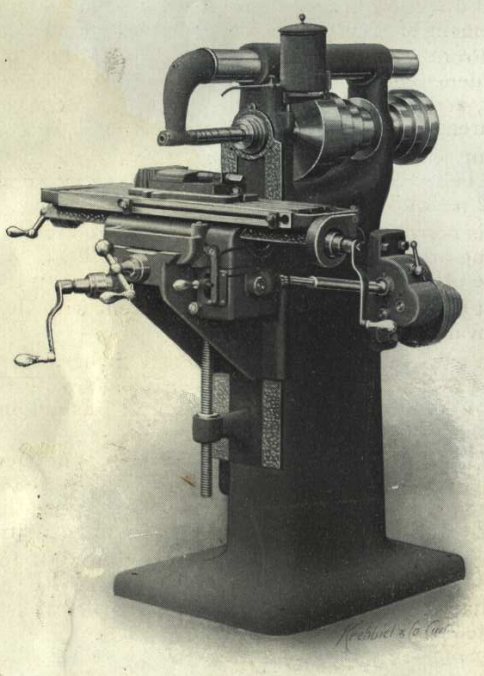
We were the first to recognize the advantage of cutting spiral gears on the Plain machine and arranged the table of all our Plain Milling Machines to receive the Dividing Head and change gears in connection with the table screw for spiral work. This does not interfere with the quick return to table, which can be used in cutting spirals, and is an invaluable feature on this class of work.

The Feed Mechanism as applied to "LeBlond" Plain Milling Machines, is of the most simple and substantial construction. The drive is direct to the feed screw through spur gearing, with the absence of all clutches, bevel gears, etc. The same construction is employed on Machines with power feed in all directions, it is such that the customer can, at any time, procure all feed parts and attach them at his own shop.

All Plain Millers are furnished with automatic longitudinal feed to table in both directions. Nos. 1, 1½, 2, 2½, 3 and 4 can be furnished with automatic cross and vertical feed if so ordered.

Dimensions "LeBlond" Plain Milling Machines.

SIZE OF MACHINE—	NO BACK-GEAR	SINGLE BACK-GEAR		DOUBLE BACK-GEAR		
	No. 0	No. 1	No. 1½	No. 2	No. 2½	No. 3	No. 4
RANGE—Table movement	18	24	24	28	28	34	42
Cross movement	6	7	7	8	8	10	12
Vertical movement	15	19	19	19	19	20	20
SPINDLE—Size Taper B. & S	9	10	10	10	10	11	12
Size Hole	11	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝
Diameter Nose	2⅛	3	3	3	3	3¼	3¾
Threads per inch	5	5	5	5	5	5	4
Speeds	8	8	12	12	18	18	18
Range of speeds	62–362	55–310	12–361	12–361	17–392	12½–362	10–350
CONE—Diameter of sections	6⅞–10	8½–12	8–11	8–11	7½–11	8½–13	9½–14½
Number of sections	4	4	3	3	3	3	3
Width of belt	2½	3	3	3	3	3½	4½
BACK-GEARS—Ratio of	.....	.....	6½–1	6½–1	3 & 10–1	3 & 10–1	3½&12–1
OVERARM—							
Greatest dist. bet. column and brace	.....	20⅝	20⅝	21¾	21¾	25¾	28¾
" to center of Spindle	5⅛	6¼	6¼	6¼	6¼	7⅜	8¼
TABLE—Width	8⅛	10½	10½	11¼	11¼	13½	16¼
Length over all	34½	46	46	52	52	63	73¾
Working surface	8⅛x27½	10½x41¼	10½x41¼	11¼x47¼	11¼x47¼	13½x58¼	16¼x67
Number of T-slots	3	3	3	3	3	3	3
Size of T-slots	½	⅝	⅝	⅝	⅝	⅝	¾
FEEDS—Number of Feeds	8	8	15	16	16	16	48
Range of Feeds	.004–.100	.004–.100	.004–.143	.004–.170	.004–.170	.006–.255	.003–1.00
Positive Geared or Belt Drive	belt	belt	belt	geared	geared	geared	geared
COUNTERSHAFT—Pulleys, diameter	10 and 14	10 and 14	10 and 14	10 and 14	14	16	18
Face of Pulleys	¼	¾	¾	¾	4¼	4¾	5¼
Kind of Friction	hub	hub	hub	hub	rim	rim	r.m
Speed REV. PER MIN	90 & 250	90 & 240	110 & 265	110 & 265	205 & 245	180 & 220	185 & 230
WEIGHT—Net LBS	1350	2200	2590	2900	3090	4700	6800
Shipping LBS	1500	2400	2890	3200	3250	5200	7200
Boxed LBS	1800	2800	3100	3650	3790	5800	8200



No. 0 Plain

No. 0 "LeBlond" Plain Milling Machine.

RANGE. This machine has an automatic feed to table of 18 inches in either direction, a cross movement of 6 inches, and a vertical movement of 15 inches below center of spindle.

SPINDLE. Front journal is made tapering, is 2½ inches in diameter, hardened and ground. It can be adjusted to compensate for wear, and is provided with perfect oiling facilities. Front end is threaded and has No. 9 B. & S. taper hole.

CONE has four sections, 6⅞, 7⅞, 9 and 10 inches in diameter, for 2½-inch belt. There are eight changes of speed, ranging from 62 to 362 revolutions per minute.

OVER-ARM is bored out and bushed with a taper bronze bush for supporting arbor, and in extreme position will be 14¼ inches from face of column.

ARBOR is not furnished, but No. 11 Arbor is sent with the machine on approval.

TABLE has a working surface of 8⅛ by 27½ inches. Length over all is 34½ inches. It has three ½-inch T-slots, with oil pockets at ends of table and oil grooves on sides. Has automatic feed of 18 inches in either direction.

ADJUSTMENTS are all furnished with handles, it is not necessary to move a handle from one to another—all handles are removable. All movements are graduated and can be read to one-thousandth of an inch. The dials can be set to zero in any position.

FEEDS. There are eight changes, ranging from .004 to .100 per revolution of spindle. The feed pulleys are 4, 5¼, 6⅝ and 8 inches diameter, for 1¼-in. belt. Lower one can be adjusted for belt tension.

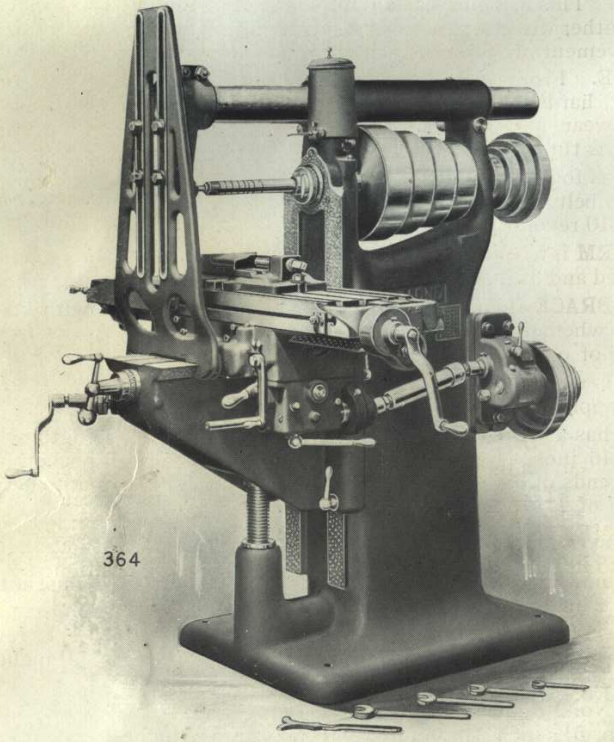
VISE. No. 2 Plain Vise is furnished with the machine, is 1⅜ inch deep, 5½ wide, and will take in 3½ inches.

COUNTERSHAFT has double friction pulleys, 14 and 10 inches in diameter, 3¼-inch face and should run 90 and 250 per minute.

FURNISHINGS include Oil Pot, Wrenches, Countershaft, etc.

FLOOR SPACE, 56 inches in line with spindle, by 68½ to take in full travel of table.

WEIGHT, Net, 1385 lbs.; shipping, 1500 lbs.; boxed, 1800 lbs.



No. 1 Plain

No. 1 "LeBlond" Plain Milling Machine.

RANGE. This machine has an automatic feed to table of 24 inches in either direction, a cross movement of 7 inches, and vertical movement of 19 inches below center of spindle.

SPINDLE. Front journal is made tapering, is $2\frac{3}{16}$ inches in diameter, hardened and ground. It can be adjusted to compensate for wear, and is provided with perfect oiling facilities. Front end is threaded and has No. 10, B. & S. taper hole.

CONE has four sections, 8½, 9¾, 11 and 12-inch diameters, for 3-inch belt. There are eight changes of speed ranging from 55 to 310 revolutions per minute.

OVER-ARM is a solid bar of steel, and furnished with arbor support, bored and bushed with taper bronze bush for supporting arbor.

ARBOR BRACE is furnished for connecting arbor support with knee and when set in the extreme position will be $20\frac{5}{8}$ inches from face of column.

ARBOR is not furnished, but Nos. 15 and 19 are sent with machine on approval.

TABLE has a working surface of 10½ by 41¼ inches. Length over all 46 inches. Has three ⅝-inch T-slots, with oil pockets at the ends of table and oil grooves on sides. Has an automatic feed of 24 inches in either direction.

ADJUSTMENTS are all furnished with handles, it is not necessary to move a handle from one to another—all handles are removable. All movements are graduated and can be read to one-thousandth of an inch. The dials can be set to zero in any position.

FEEDS. There are eight changes, ranging from .004 to .10 per revolution of spindle. Feed pulleys are 5, 6¾, 8⅜ and 10 inches diam. for 1¼-in. belt. Lower one can be adjusted for tension.

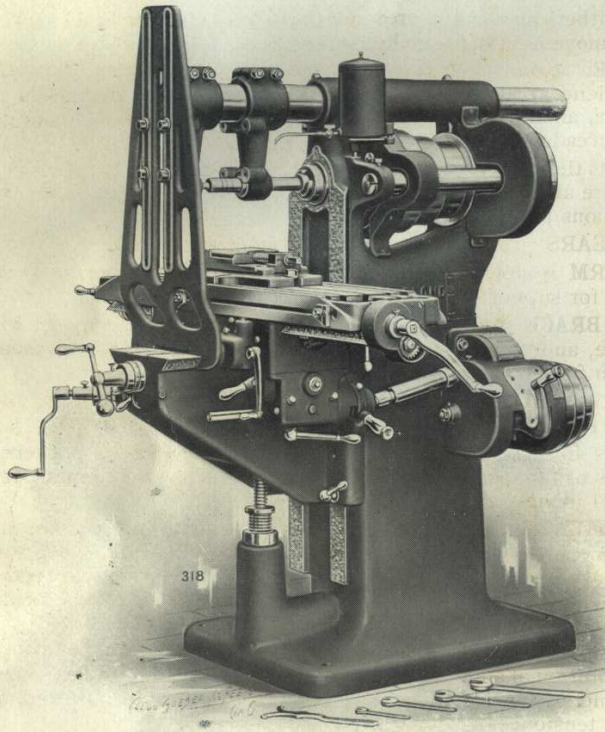
VISE. No. 2 Plain Vise is furnished with machine and is 1⅜ inch deep, 5½ inches wide, and will take in 3½ inches.

COUNTERSHAFT has double friction pulleys, 14 and 10 inches in diameter, 3¾-inch face and should run 90 and 240 per minute.

FURNISHINGS include Oil Pot, Wrenches, Countershaft, etc.

FLOOR SPACE, 75 inches in line with spindle by 88 to take in full travel of table.

WEIGHT, Net, 2200 lbs.; shipping, 2400 lbs.; boxed, 2800 lbs.



No. 1½ Plain

No. 1½ "LeBlond" Plain Milling Machine.

RANGE. This machine has an automatic feed to table of 24 inches in either direction, a cross movement of 7 inches, and a vertical movement of 19 inches below center of spindle.

SPINDLE. Front journal is made tapering, is 2⅛ inches diameter, hardened and ground. It can be adjusted to compensate for wear, and is provided with perfect oiling facilities. Front end is threaded and has No. 10 B. & S. taper hole.

CONE has three sections, 8, 9½ and 11-in. diameters, for 3-in. belt. There are twelve changes of speed ranging from 12 to 361 revolutions per minute.

BACK-GEARS. Machine is single back-geared at ratio of 6½ to 1.

OVER-ARM is solid bar of steel furnished with two arbor supports, one for supporting end the other the middle of arbor.

ARBOR BRACE is furnished for connecting the arbor support with knee, and when set in the extreme position will be 20⅝ inches from face of column.

ARBOR is not furnished, but Nos. 18 and 22 are sent on approval.

TABLE has a working surface of 10½ by 41¼ inches. Length over all is 46 inches. Has three ⅝-in. T-slots, with oil pockets at ends of table and oil grooves on sides. Has an automatic feed of 24 inches in either direction.

ADJUSTMENTS. Handles are on all adjustments and it is not necessary to move a handle from one to another—all handles are removable. All movements are graduated and can be read to one-thousandth of an inch. The dials can be set to zero in any position.

FEEDS. There are fifteen changes, ranging from .006 to .143 per revolution of spindle. Feed pulleys are 9¼, 10⅛ and 11 inches diameter, for 1½-inch belt. Lower one can be adjusted for belt tension.

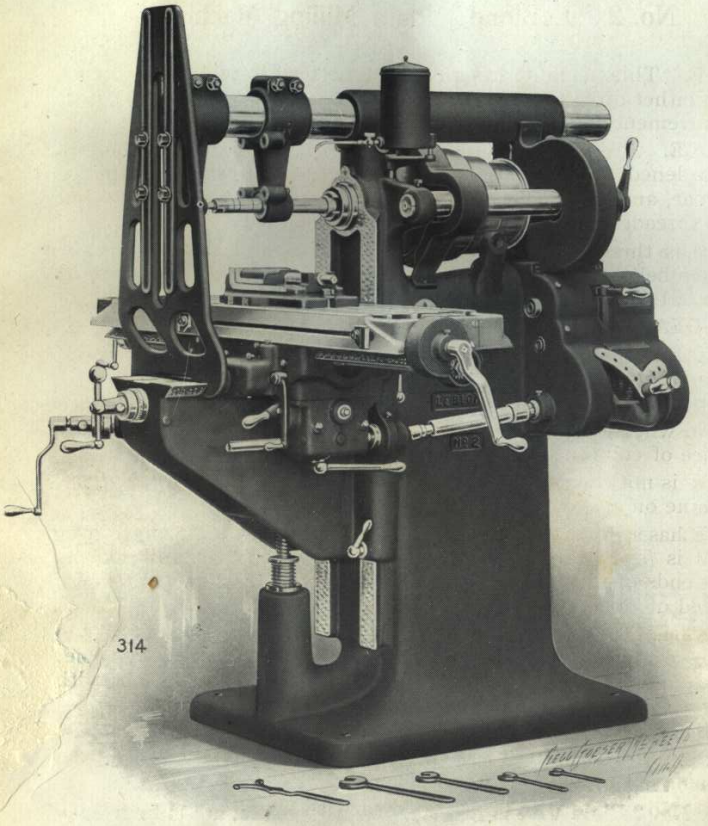
VISE. No. 2 Plain Vise is furnished with machine, is 1⅜ inch deep, 5½ inches wide and will take in 3½ inches.

COUNTERSHAFT has double friction pulleys, 14 and 10 inches in diameter, 3¾-inch face and should run 110 and 265 per minute.

FURNISHINGS include Oil Pot, Wrenches, Countershaft, etc.

FLOOR SPACE, 75 inches in line with spindle, by 88 to take in full travel of table.

WEIGHT, Net, 2590 lbs.; shipping, 2890 lbs.; boxed, 3100 lbs.



No. 2 Plain

No. 2 "LeBlond" Plain Milling Machine.

RANGE. This machine has an automatic feed to table of 28 inches in either direction, a cross movement of 8 inches, and vertical movement of 19 inches below center of spindle.

SPINDLE. Front journal is made tapering, is $2\frac{15}{16}$ inches diameter hardened and ground. It can be adjusted to compensate for wear, and is provided with perfect oiling facilities. Front end is threaded and has No. 10 B. & S. taper hole.

CONE has three sections, 8, 9½ and 11 inches in diameter, for 3-inch belt. There are twelve changes of speed ranging from 12 to 361 revolutions per minute.

BACK-GEARS. Machine is single back-geared at ratio of 6½ to 1.

OVER-ARM is solid bar of steel, furnished with two arbor supports, one for supporting end, the other the middle of arbor.

ARBOR BRACE is furnished for connecting arbor support with knee and when set in the extreme position will be 21¾ inches from face of column.

ARBOR is not furnished, but Nos. 18 and 22 are sent with the machine on approval.

TABLE has a working surface of 11¼ by 47¼ inches. Length over all is 52 inches. It has three ⅝-in. T-slots, with oil pockets at ends of table and oil grooves on sides. It has an automatic feed of 28 inches in either direction.

ADJUSTMENTS are all furnished with handles, it is not necessary to move a handle from one to another—all handles are removab' All movements are graduated and can be read to one-thousand. of an inch. The dials can be set to zero in any position.

FEEDS are positively driven through spur gears, with 16 changes, ranging from .004 to .170 per revolution of spindle. All feed changes are made with two levers.

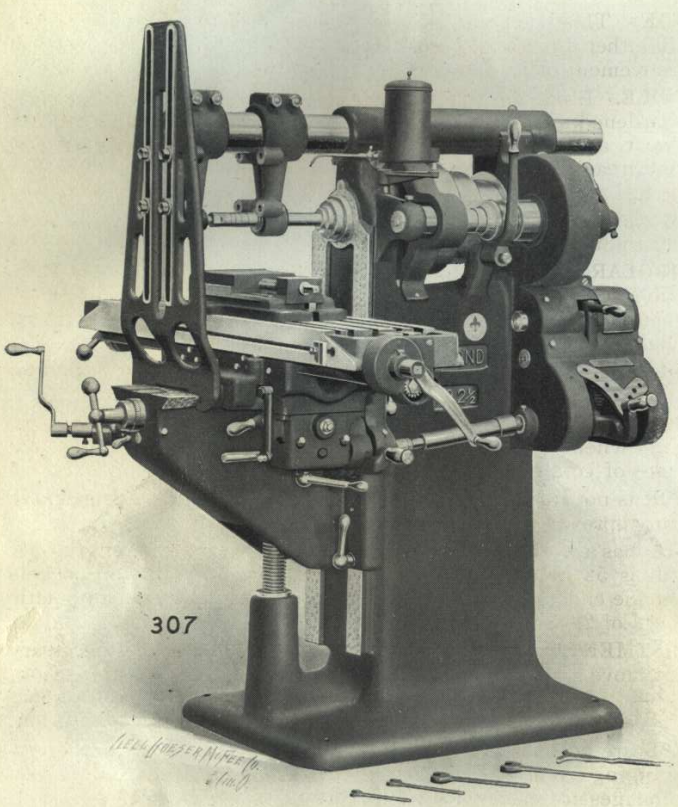
VISE. No. 2 Plain Vise is furnished with machine, it is 1⅜ inch deep, 5½ inches wide, and will take in 3½ inches.

COUNTERSHAFT has double friction pulleys, 14 and 10 inches in diameter, 3¾-in. face and should run 110 and 265 per minute.

FURNISHINGS include Oil Pot, Wrenches, Countershaft, etc.

FLOOR SPACE, 81 inches in line with spindle by 98 to take in full travel of table.

WEIGHT, Net, 2900 lbs.; shipping, 3200 lbs.; boxed, 3650 lbs.



No. 2½ Plain

No. 2½ "LeBlond" Plain Milling Machine.

RANGE. This machine has an automatic feed to table of 28 inches in either direction, a cross movement of 8 inches, and vertical movement of 19 inches below center of spindle.

SPINDLE. Front journal is made tapering, is $2\frac{15}{16}$ inches diameter, hardened and ground. It can be adjusted to compensate for wear, and is provided with perfect oiling facilities. Front end is threaded and has No. 10 B. & S. taper hole.

CONE has three sections, 7½, 9¼ and 11 inches in diameter, for 3-inch belt. There are eighteen changes of speed ranging from 17 to 392 revolutions per minute.

BACK-GEARS. The machine has "LeBlond" Patent Double Friction Back-Gears, giving instantaneous changes of speed without shifting a belt, and making an extraordinarily strong drive. Back-gear ratio is 3 to 1 and 10 to 1.

OVER-ARM is a solid bar of steel, furnished with two arbor supports, one for supporting end the other the middle of arbor.

ARBOR BRACE is furnished for connecting arbor support with knee, and when set in the extreme position will be 21¾ inches from face of column.

ARBOR is not furnished, but Nos. 18 and 22 are sent with machine on approval.

TABLE has a working surface of 11¼ by 47¼ inches. Length over all is 52 inches. It has three ⅝-in. T-slots, with oil pockets at the ends of table and oil grooves on sides. Has an automatic feed of 28 inches in either direction.

ADJUSTMENTS are all furnished with handles, it is not necessary to move a handle from one to another—all handles are removable. All movements are graduated and can be read to one-thousandth of an inch. Dials can be set to zero in any position.

FEEDS are positively driven through spur gears, with 16 changes ranging from .004 to .170 per revolution of spindle. All feed changes are made with two levers.

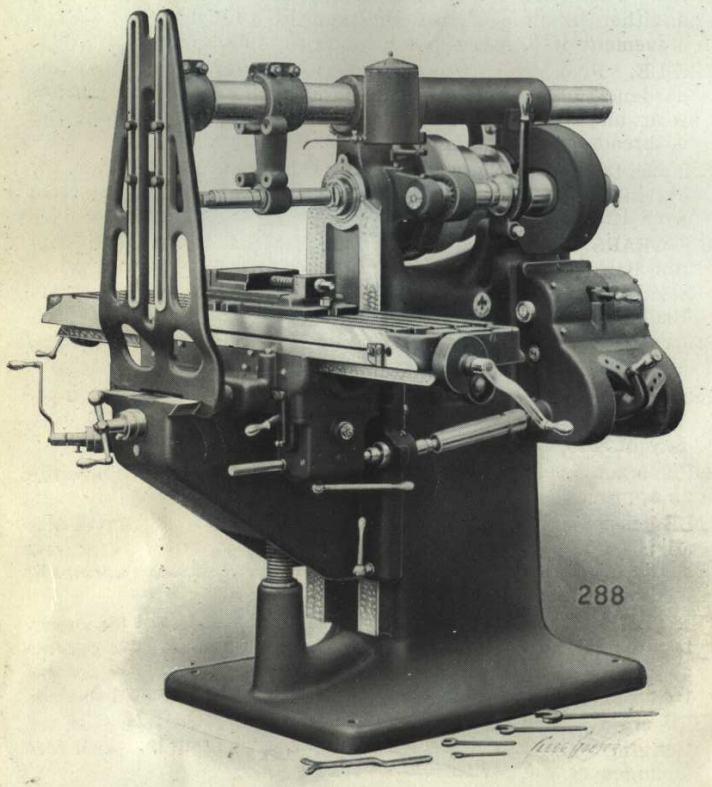
VISE. No. 2 Plain Vise is furnished with machine, it is 1⅜-inch deep, 5½ inches wide, and will take in 3½ inches.

COUNTERSHAFT has double friction pulleys, 14 inches in diameter and 4¼ inches face and should run 205 and 245 per minute.

FURNISHINGS include Oil Pot, Wrenches, Countershaft, etc.

FLOOR SPACE, 81 inches in line with spindle, by 98 to take in full travel of table.

WEIGHT, Net, 3090 lbs.; shipping, 3250 lbs.; boxed, 3790 lbs.



No. 3 Plain

No. 3 "LeBlond" Plain Milling Machine.

RANGE. This machine has an automatic feed to table of 34 inches in either direction, a cross movement of 10 inches, and vertical movement of 20 inches below center of spindle.

SPINDLE. Front journal is made tapering, is $3\frac{13}{16}$ inches diameter, hardened and ground. It can be adjusted to compensate for wear, and is provided with perfect oiling facilities. Front end is threaded and has No. 11 B. & S. taper hole.

CONE has three sections, 8½, 10¾ and 13 inches in diameter, for 3½-inch belt. There are eighteen changes of speed, ranging from 12½ to 362 revolutions per minute.

BACK-GEARS. The machine has "LeBlond" Patent Double Friction Back-Gears, giving instantaneous changes of speed without shifting a belt, and making an extraordinarily strong drive. Back-gear ratio is 3 to 1 and 10 to 1.

OVER-ARM is a solid bar of steel, furnished with two arbor supports, one for supporting end, the other the middle of arbor.

ARBOR BRACE is furnished for connecting arbor support with knee, and when set in the extreme position will be 25¾ inches from face of column.

ARBOR is not furnished, but Nos. 36 and 40 are sent with machine on approval.

TABLE has a working surface of 13½ by 58¼ inches. Length over all is 63 inches. It has three ⅝-inch T-slots, with oil pockets at the ends of table and oil grooves on sides. Has an automatic feed of 34 inches in either direction.

ADJUSTMENTS are all furnished with handles, it is not necessary to move a handle from one to another—all handles are removable. All movements are graduated and can be read to one-thousandth of an inch. Dials can be set to zero in any position.

FEEDS are positively driven through spur gears, with 16 changes, ranging from .006 to .255 per revolution of spindle. All feed changes are made with two levers.

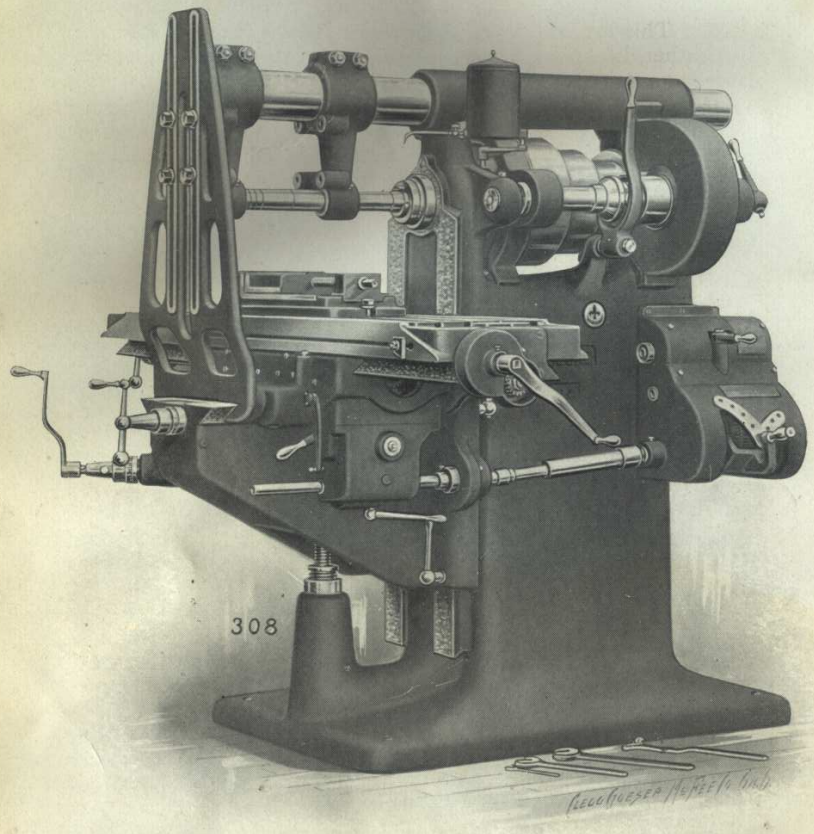
VISE. No. 3 Plain Vise is furnished with machine, it is $1\frac{15}{16}$-inch deep, 7¼ inches wide, and will take in 5 inches.

COUNTERSHAFT has double friction pulleys, 16 inches in diameter and 4¾ inches face, and should run 180 and 220 per minute.

FURNISHINGS include Oil Pot, Wrenches, Countershaft, etc.

FLOOR SPACE, 95 inches in line with spindle, by 115 to take in full travel of table.

WEIGHT, Net, 4700 lbs.; shipping, 5200 lbs.; boxed, 5800 lbs.



No. 4 Plair.

No. 4 "LeBlond" Plain Milling Machine.

RANGE. This machine has an automatic feed to table of 42 inches in either direction; cross movement of 12 inches, and vertical movement of 20 inches below the center of spindle.

SPINDLE. Front journal is made tapering, is 4⅛ inches diameter, hardened and ground. It can be adjusted to compensate for wear, and is provided with perfect oiling facilities. Front end is threaded and has No. 12 B. & S. taper hole.

CONE has three sections, 9½, 12 and 14½-inch diameters, for 4½-inch belt. There are eighteen changes of speed ranging from 10 to 350 revolutions per minute.

BACK-GEARS. The machine is double back-geared, giving instantaneous changes of speed without shifting a belt, and making an extraordinarily strong drive. Back-gear ratio 3½-1 and 12-1.

OVER-ARM is a solid bar of steel, furnished with two arbor supports, one for supporting end, the other the middle of the arbor.

ARBOR BRACE is furnished for connecting the arbor support with knee and when set in the extreme position will be 28¾ inches from face of column.

ARBOR is not furnished, but Nos. 50 and 53 are sent with the machine on approval.

TABLE has a working surface of 16¼ by 67 inches. Length over all 73¾ inches. Has three ¾-inch T-slots, with oil pockets at ends of table and oil grooves on sides. Has an automatic feed of 42 inches in either direction.

ADJUSTMENTS. Handles are on all adjustments and it is not necessary to move a handle from one to another—all handles are removable. All movements are graduated and can be read to one-thousandth of an inch. Dials can be set to zero in any position.

FEEDS are positively driven through spur gears. There are sixteen changes ranging from .003 to .129 for small mills; .010 to .448 for medium; and .037 to 1.60 for large mills. All feed changes are made with two levers.

VISE. No. 4 Plain Vise is furnished with the machine, it is 2½ inches deep, 8½ wide, and takes in 7 inches.

COUNTERSHAFT has double friction pulleys 18 inches in diameter, 5¼ face and should run 185 and 230 revolutions per minute.

FURNISHINGS include Oil Pot, Wrenches, Countershaft, etc.

FLOOR SPACE, 109 inches in line with spindle, by 138 to take in full travel of table.

WEIGHT, Net, 6,800 lbs.; shipping, 7,200 lbs.; boxed, 8,200 lbs.

"LeBlond" Universal Milling Machines.

The Universal Milling Machine is the same as the Plain except that provisions are made for swiveling the table and automatically rotating the universal head spindle. They are especially useful in tool rooms or where there is a large variety of work. They can perform every operation of which a Plain Machine is capable, having, in addition to the parts of the Plain machine, the swiveling table and universal head, with means for rotating the spindle, giving facilities for cutting spirals, notching worm wheels, etc.

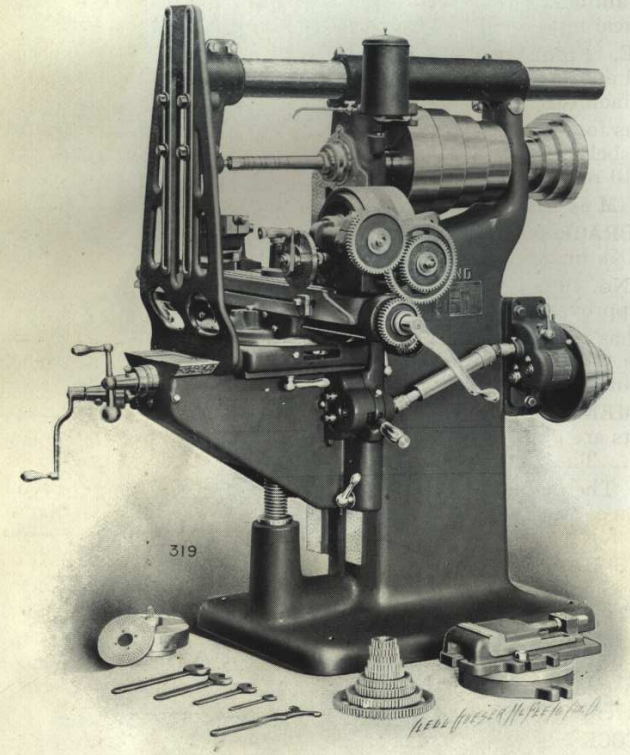
Universal machines are not as good as Plain millers for manufacturing purposes: the swiveling feature adds one more joint, and also lessens the vertical range. The feeding mechanism has to be brought up through the center of the swivel, restricting the design, consequently they can not be made as simple and substantial as a Plain machine. However, these are the faults of the type and not of the machine, and we have reduced them to a minimum.

The swivel bases are of large diameter and are clamped in position with three bolts in a T-slot, the slot being at the extreme outside of the base, gives a strong leverage and practically making the swivel and saddle one piece. The bases are graduated to degrees, and owing to the large diameter the divisions are quite a distance apart, allowing for accurately setting the swivel. The saddles are extremely long, the bearing is not sacrificed to procure swivel movement. The feed is powerful and will automatically trip to a line under any cut at any angle.

All Universal milling machines will cut spirals up to and including 50 degrees, right or left hand. Provisions are made for connecting the head with simple or compound gearing, giving an exceedingly large range. Nos. 1, 1½, 2, 2½ and 3 Universal are furnished regularly with automatic cross and longitudinal feed. No. 4 Universal has automatic feeds in all directions. In most other respects, such as feeds, spindle speeds, belt power, etc., the Universal machines are the same as the corresponding size of the Plain machines.

Dimensions "LeBlond" Universal Milling Machines.

SIZE OF MACHINE—	No B'k Gear	SINGLE BACK-GEAR'D		DOUBLE BACK-GEARED			
	No. 1	No. 1½	No. 2	No. 2½	No. 3	No. 4
RANGE—Table movement	20	20	25	25	30	35
Cross movement	7	7	8	8	10	12
Vertical movement	18	18	18	18	19	20
SPINDLE—Size Taper B. & S.	10	10	10	10	11	12
Size Hole	1⅛	1⅛	1⅛	1⅛	1⅛	1⅜
Diameter Nose	3	3	3	3	3¼	3¾
Threads per inch	5	5	5	5	5	4
Speeds	8	12	12	18	18	18
Range of speeds	55–310	12–361	12–361	17–392	12½–362	10–350
CONE—Diameter of sections	8½–12	8–11	8–11	7½–11	8½–13	9½–14½
Number of sections	4	3	3	3	3	3
Width of belt	3	3	3	3	3½	4½
BACK-GEARS—Ratio of	....	6½–1	6½–1	3 & 10–1	3 & 10–1	3½ & 12–1
OVERARM—						
Greatest dist. bet. column and brace	20⅝	20⅝	21¾	21¾	25¾	28¾
" to center of spindle	6¼	6¼	6¼	6¼	7⅜	8¼
TABLE—Width	9½	9½	10	10	12	15
Length over all	41	41	46½	46½	57½	68¼
Working surface	9½x36¼	9½x36¼	10x41¾	10x41¾	12x43½	15x61¾
Number of T-slots	3	3	3	3	3	3
Size of T-slots	⅝	⅝	⅝	⅝	⅝	¾
FEEDS—Number of Feeds	8	15	16	16	16	48
Range of Feeds	.004–.100	.006–.143	.004–.170	.004–.170	.006–.255	.003–1.60
Positive Geared or Belt Drive	belt	belt	geared	geared	geared	geared
DIVIDING HEAD—Swings	10¼	10¼	10¼	10¼	12¼	15
Takes between Centers	15	15	20	20	30½	35
Combined length	21¾	21¾	21¾	21¾	29½	26½
Cuts Spirals	1.55–137	1.55–137	1.55–137	1.55–137	1.55–137	1.55–137
COUNTERSHAFT—Pulleys, diameter	10 and 14	10 and 14	10 and 14	14	16	18
Face of Pulleys	3¾	3¾	3¾	4¼	4¾	5¼
Kind of Friction	hub	hub	hub	rim	rim	rim
Speeds REV. PER MIN	90 & 240	110 & 265	110 & 265	205 & 245	180 & 220	185 & 230
WEIGHT—Net LBS	2550	2690	3150	3270	5160	7150
Shipping LBS	2800	2800	3400	3500	5400	7700
Boxed LBS	3000	3050	3840	4000	6200	8800



No. 1 Universal

No. 1 "LeBlond" Universal Milling Machine.

RANGE. This machine has an automatic feed to table of 20 inches and automatic cross feed of 7 inches, in either direction; and vertical movement of 18 inches below the center of spindle.

SPINDLE. Front journal is tapering, is $2\frac{1}{16}$ inches diameter, hardened and ground. It has adjustment for wear, with perfect oiling facilities. Has No. 10 B. & S. taper hole.

CONE has four sections, $8\frac{1}{2}$, $9\frac{3}{4}$, 11 and 12 inches diameter for 3-inch belt. There are eight changes of speed, ranging from 55 to 310 revolutions per minute.

OVER-ARM is a solid bar of steel, furnished with arbor support.

ARBOR BRACE is furnished and when in the extreme position will be $20\frac{5}{8}$ inches from face of column.

ARBOR No. 19 is furnished with the machine, and No. 15 is sent on approval.

TABLE has working surface of $9\frac{1}{2}$ by $36\frac{1}{4}$ inches. Length over all is 41 inches. Has three $\frac{5}{8}$-inch T-slots, with oil pockets at end of table and oil grooves on sides.

ADJUSTMENTS are all furnished with movable handles. All movements are graduated and can be read to one-thousandth of an inch. The dial can be set to zero in any position.

FEEDS. There are 8 changes, ranging from .004 to .100 per revolution of spindle. Feed Pulleys are 5, $6\frac{3}{4}$, $8\frac{1}{2}$ and 10-in. diameter, for $1\frac{1}{4}$-in. belt. Lower one can be adjusted for tension.

DIVIDING HEAD swings $10\frac{1}{4}$ inches and takes in 15 between centers. Spindle can be set 10 deg. below the horizontal each way, and can be turned completely over from one side to the other.

INDEX PLATES. Two are furnished and will divide all numbers to 50, all even numbers to 100, and most numbers to 360. Spirals from one turn in 1.55 to one turn in 137.14 inches can be cut. Differential Indexing can be furnished.

FOOT STOCK has vertical adjustment with a screw for taper work.

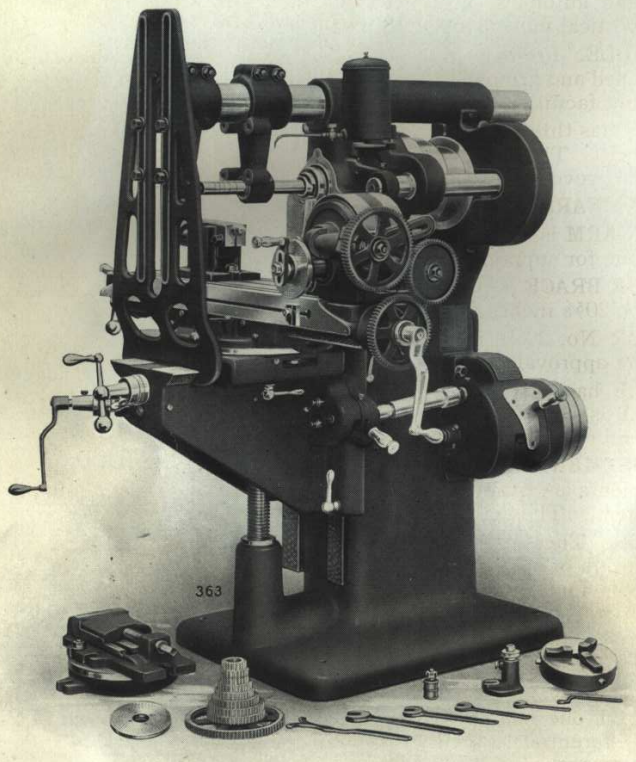
VISE. No. 2 Vise with swivel base is furnished with machine. It is $1\frac{3}{8}$ inches deep, $5\frac{1}{2}$ inches wide, and will take in $3\frac{1}{2}$ inches.

COUNTERSHAFT has double friction pulleys, 14 and 10 inches in diameter, $3\frac{3}{4}$-in. face, and should run 90 and 240 per minute.

FURNISHINGS include Oil Pot, Wrenches, Center Rest, Universal Chuck, Tables for spacing and cutting spirals, Countershaft, etc.

FLOOR SPACE, 75 inches in line with spindle, by 83 to take in full travel of table.

WEIGHT, Net, 2550 lbs.; shipping, 2800 lbs.; boxed, 3000 lbs.



No. 1½ Universal

No. 1½ "LeBlond" Universal Milling Machine.

RANGE. This machine has an automatic feed to table of 20 inches and automatic cross feed of 7 inches in either direction; and vertical movement of 18 inches below the center of spindle.

SPINDLE. Front journal is tapering, is 2⅛ inches diameter, hardened and ground. It has adjustment for wear, with perfect oiling facilities. Has No. 10 B. & S. taper hole.

CONE has three sections, 8, 9½ and 11 inches diameter for 3-inch belt. There are twelve changes of speed, ranging from 12 to 361 revolutions per minute.

BACK-GEARS. Machine is single back-geared at ratio of 6½ to 1.

OVER-ARM is solid bar of steel, furnished with two arbor supports, one for supporting end the other the middle of arbor.

ARBOR BRACE is furnished and when in the extreme position will be 20⅝ inches from face of column.

ARBOR No. 22 is furnished with the machine, and No. 18 is sent on approval.

TABLE has working surface of 9½ by 36¼ inches. Length over all is 41 inches. Has three ⅝-inch T-slots, with oil pockets at end of table and oil grooves on sides.

ADJUSTMENTS are all furnished with movable handles. All movements are graduated and can be read to one-thousandth of an inch. The dials can be set to zero in any position.

FEEDS. There are 15 changes, ranging from .006 to .143 per revolution of spindle. Feed Pulleys are 9¼, 10⅛ and 11-in. diameter, for 1½-inch belt. Lower one can be adjusted for tension.

DIVIDING HEAD swings 10¼ inches and takes in 15 between centers. Spindle can be set 10 deg. below the horizontal each way.

INDEX PLATES. Two are furnished and will divide all numbers to 50, all even numbers to 100, and most numbers to 360. Spirals from one turn in 1.55 to one turn in 137.14 inches can be cut. Differential Indexing can be furnished.

FOOT STOCK has vertical adjustment with a screw, for taper work.

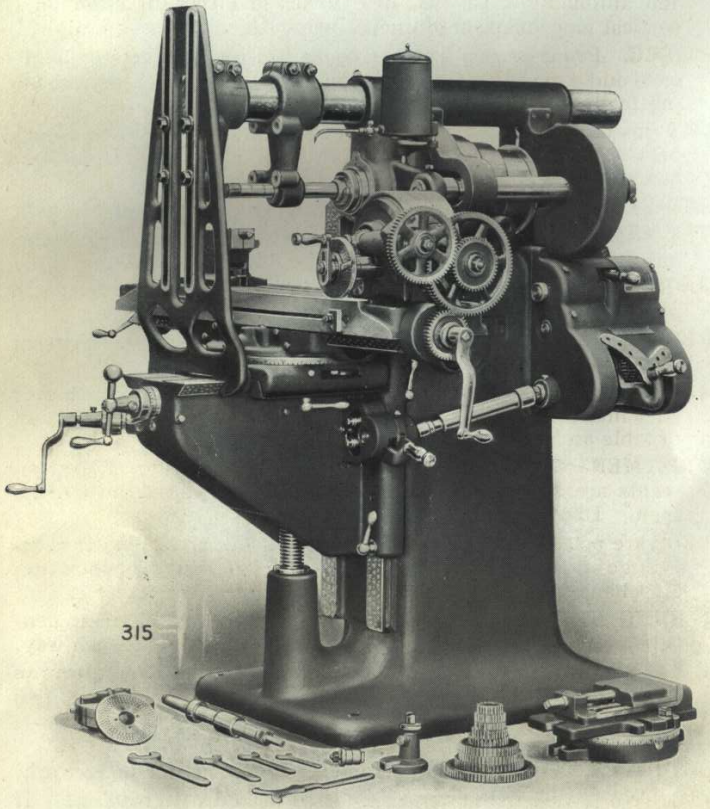
VISE. No. 2 Vise with swivel base is furnished with machine. It is 1⅜ inches deep, 5½ inches wide, and will take in 3½ inches.

COUNTERSHAFT has double friction pulleys, 14 and 10 inches in diameter, 3¾ in. face, and should run 110 and 265 per minute.

FURNISHINGS include Oil Pot, Wrenches, Center Rest, Universal Chuck, Tables for spacing and cutting spirals, Countershaft, etc.

FLOOR SPACE, 75 inches in line with spindle, by 83 to take in full travel of table.

WEIGHT, Net 2690 lbs.; shipping, 2800 lbs.; boxed 3050 lbs.



No. 2 Universal

No. 2 "LeBlond" Universal Milling Machine.

RANGE. This machine has an automatic feed to table of 25 inches and automatic cross feed of 8 inches in either direction; and vertical movement of 18 inches below the center of spindle.

SPINDLE. Front journal is tapering, is $2\frac{15}{16}$ inches diameter, hardened and ground. It has adjustment for wear with perfect oiling facilities. Has No. 10 B. & S. taper hole.

CONE has three sections, 8, 9½ and 11 inches diameter for 3-inch belt. There are twelve changes of speed ranging from 12 to 361 revolutions per minute.

BACK-GEARS. Machine is single back-geared at ratio of 6½ to 1.

OVER-ARM is solid bar of steel, furnished with two arbor supports, one for supporting end the other the middle of arbor.

ARBOR BRACE is furnished and when in the extreme position will be 21¾ inches from face of column.

ARBOR No. 22 is furnished with the machine, and No. 18 is sent on approval.

TABLE has working surface of 10 by 41¾ inches. Length over all 46½ inches. Has three ⅝-inch T-slots, with oil-pockets at end of table and oil-grooves on sides.

ADJUSTMENTS are all furnished with movable handles. All movements are graduated and can be read to one-thousandth of an inch. Dials can be set to zero in any position.

FEEDS are positively driven through spur gears. There are sixteen changes, ranging from .004 to .170 per revolution of spindle. All changes are made by the two levers.

DIVIDING HEAD swings 10¼ inches and takes 20 between centers. Spindle can be set 10 degrees below horizontal each way.

INDEX PLATES. Two are furnished and will divide all numbers to 50, all even numbers to 100, and most numbers to 360. Spirals from one turn in 1.55 to one turn in 137.14 inches can be cut. Differential Indexing can be furnished.

FOOT STOCK has vertical adjustment with a screw, for taper work.

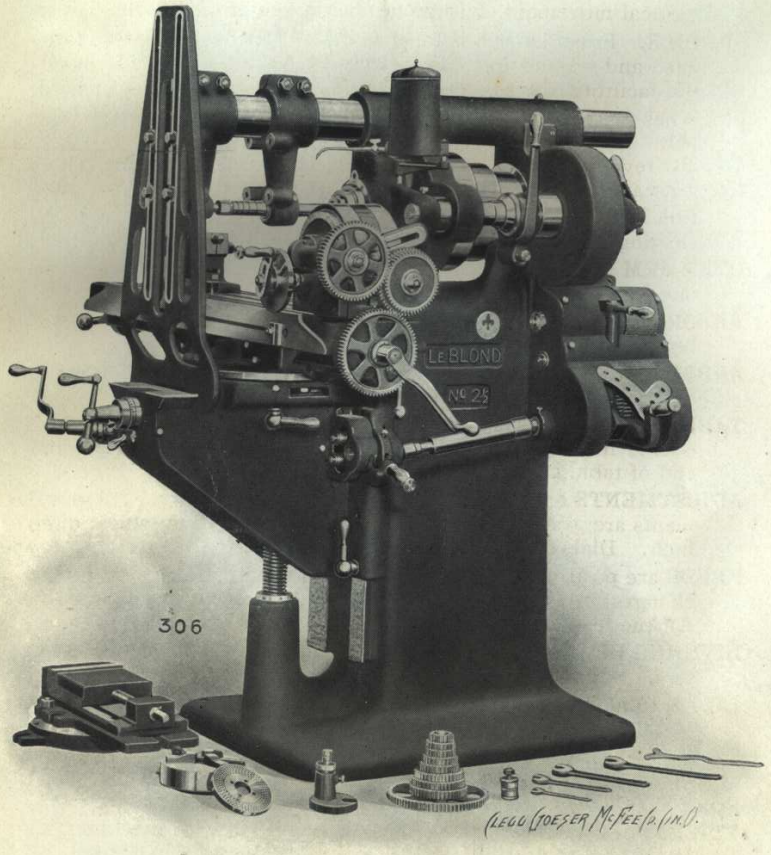
VISE. No. 2 Vise with swivel base is furnished with machine. It is 1⅜ inches deep, 5½ wide, and will take in 3½ inches.

COUNTERSHAFT has double friction pulleys 14 and 10 inches in diameter, 3¾-in. face, and should run 110 and 265 per minute.

FURNISHINGS include Oil Pot, Universal Chuck, Wrenches, Index Tables for spacing and cutting spirals, Countershaft, etc.

FLOOR SPACE. 81 inches in line with spindle, by 94 to take in full travel of table.

WEIGHT, Net, 3150 lbs.; shipping, 3400 lbs.; boxed, 3840 lbs.



No. 2½ Universal

No. 2½ "LeBlond" Universal Milling Machine.

RANGE. This machine has an automatic feed to table of 25 inches and automatic cross feed of 8 inches in either direction; and a vertical movement of 18 inches below center of spindle.

SPINDLE. Front journal is tapering, is $2\frac{1}{16}$ inches diameter, hardened and ground. It has adjustment for wear, and perfect oiling facilities. Has No. 10 B. & S. taper hole.

CONE has three sections, 7½, 9¼ and 11 inches diameter, for 3-inch belt. There are eighteen changes of speed ranging from 17 to 392 revolutions per minute.

BACK-GEARS. The machine has "LeBlond" Patent Double Friction Back-Gears, giving instantaneous changes of speed without shifting a belt. Back-gear ratio 3 to 1 and 10 to 1.

OVER-ARM is solid bar of steel, furnished with two arbor supports, one for supporting end the other the middle of arbor.

ARBOR BRACE is furnished and when in the extreme position will be 21¾ inches from face of column.

ARBOR. No. 22 is furnished with the machine and No. 18 is sent on approval.

TABLE has working surface of 10 by 41¾ inches. Length over all is 46½ inches. Has three ⅝-inch T-slots, with oil pockets at end of table and oil grooves on sides.

ADJUSTMENTS are all furnished with removable handles—all movements are graduated and can be read to one-thousandth of an inch. Dials can be set to zero in any position.

FEEDS are positively driven through spur gears. There are sixteen changes, ranging from .004 to .170 per revolution of spindle. All the feed changes are made by the two levers.

DIVIDING HEAD swings 10¼ inches and takes in 20 between centers. Spindle can be set 10 degrees below horizontal each way.

INDEX PLATES. Two are furnished and will divide all numbers to 50, all even numbers to 100 and most numbers to 360. Spirals from one turn in 1.55 inches to one turn in 137.14 inches can be cut. Differential Indexing can be furnished.

FOOT STOCK has vertical adjustment with a screw, for taper work.

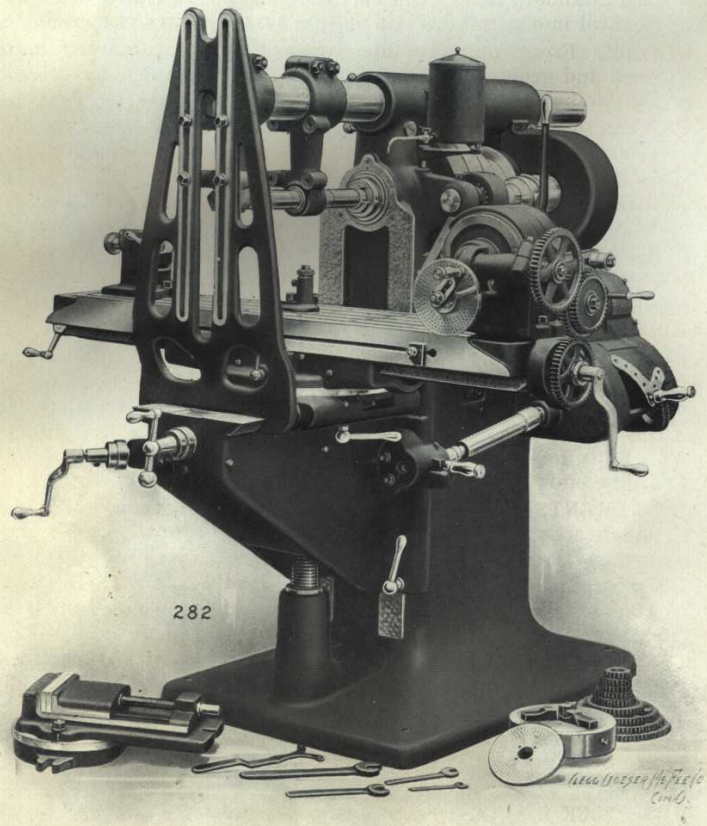
VISE. No. 2 Vise with swivel base is furnished with machine. It is 1⅜ inches deep, 5½ inches wide, and will take in 3½ inches.

COUNTERSHAFT has double friction pulleys, 14 inches in diameter, 4¼-inch face and should run 205 and 245 revs. per minute.

FURNISHINGS include Oil Pot, Wrenches, Universal Chuck, Tables for spacing and cutting spirals, Countershaft, etc.

FLOOR SPACE, 81 inches in line with spindle, by 94 to take in full travel of table.

WEIGHT, Net, 3270 lbs.; shipping, 3500 lbs.; boxed, 4000 lbs.



No. 3 Universal

No. 3 "LeBlond" Universal Milling Machine.

RANGE. This machine has an automatic feed to table of 30 inches and automatic cross feed of 10 inches in either direction; and vertical movement of 19 inches below the center of spindle.

SPINDLE. Front journal is tapering, is $3\frac{3}{16}$ inches diameter, hardened and ground. It has adjustment for wear with perfect oiling facilities. Has No. 11 B. & S. taper hole.

CONE has three sections, $8\frac{1}{2}$, $10\frac{3}{4}$ and 13 inches diameter for $3\frac{1}{2}$-inch belt. There are eighteen changes of speed ranging from $12\frac{1}{2}$ to 362 revolutions per minute.

BACK-GEARS. The machine has "LeBlond" Patent Double Friction Back-Gears, giving instantaneous change of speed without shifting a belt Back-gear ratio 3 to 1 and 10 to 1.

OVER-ARM is solid bar of steel, furnished with two arbor supports, one for supporting end the other the middle of arbor.

ARBOR BRACE is furnished and when in the extreme position will be $25\frac{3}{4}$ inches from face of column.

ARBOR No. 40 is furnished with the machine, and No. 36 is sent on approval.

TABLE has working surface of 12 by $52\frac{3}{4}$ inches. Length over all is $57\frac{1}{2}$ inches. It has three $\frac{5}{8}$-inch T-slots, with oil pockets at the ends of table and oil grooves on sides.

ADJUSTMENTS are all furnished with movable handles—all movements are graduated and can be read to one-thousandth of an inch. The dials can be set to zero in any position.

FEEDS are positively driven through spur gears. There are 16 changes ranging from .006 to .255 per revolution of spindle, all changes are made with the two levers.

DIVIDING HEAD swings $12\frac{1}{4}$ inches and takes in $30\frac{1}{2}$ between centers. Spindle can be set 10 deg. below horizontal each way.

INDEX PLATES. Two are furnished and will divide all numbers to 50, all even numbers to 100 and most numbers to 360. Spirals from one turn in 1.55 inches to one turn in 137.14 inches can be cut. Differential Indexing can be furnished.

FOOT STOCK has vertical adjustment with a screw, for taper work.

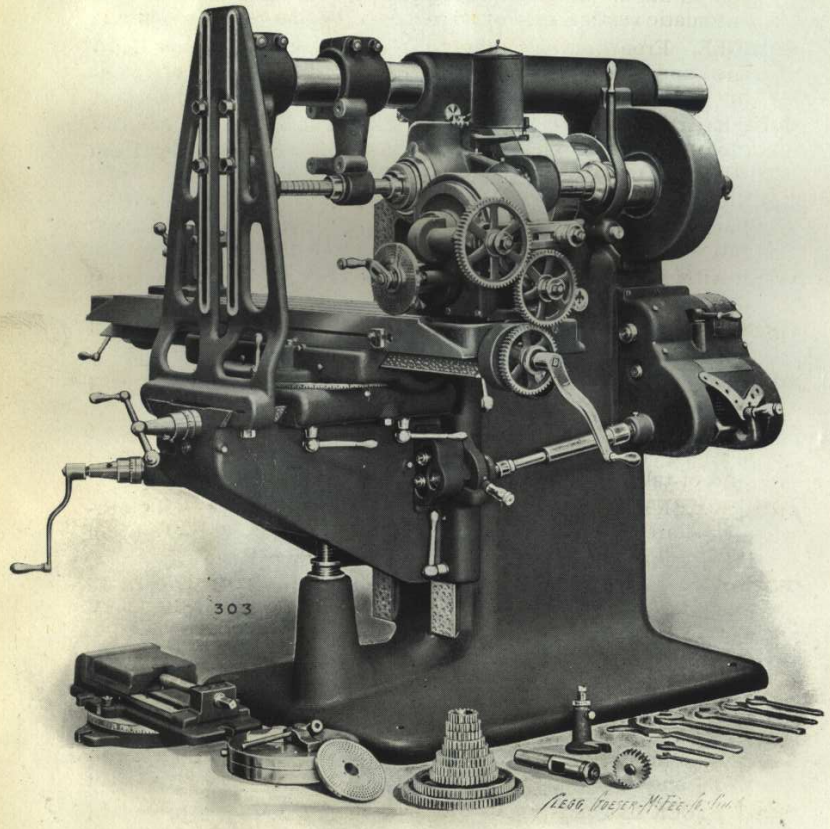
VISE. No. 3 Vise with swivel base is furnished with machine. It is $1\frac{5}{16}$ inches deep, $7\frac{1}{4}$ inches wide, and will take in 5 inches.

COUNTERSHAFT has double friction pulleys 16 inches in diameter and $4\frac{3}{4}$-in. face and should run 180 and 220 revs. per minute.

FURNISHINGS include Oil Pot, Wrenches, Universal Chuck, Index Tables for spacing and cutting spirals, Countershaft, etc.

FLOOR SPACE, 95 inches in line with spindle by 106 to take in full travel of table.

WEIGHT, Net, 5160 lbs.; shipping, 5400 lbs.; boxed, 6200 lbs.



No. 4 Universal

No. 4 "LeBlond" Universal Milling Machine.

RANGE. This machine has an automatic feed to table of 35 inches, and an automatic cross feed of 12 inches in either direction, and automatic vertical feed of 20 inches below the center of spindle.

SPINDLE. Front journal is tapering, is 4⅛ inches diameter, hardened and ground. It has adjustment for wear, with perfect oiling facilities. Has No. 12 B. & S. taper hole.

CONE has three sections, 9½, 12 and 14½ inches diameter, for 4½-inch belt. There are eighteen changes of speed, ranging from 10 to 350 revolutions per minute.

BACK-GEARS. The machine is double back-geared, giving instantaneous changes of speed without shifting a belt. Back-gear ratios 3½ to 1 and 12 to 1.

OVER-ARM is a solid bar of steel, furnished with two arbor supports, one for supporting end the other the middle of arbor.

ARBOR BRACE is furnished, and when in the extreme position will be 28¾ inches from face of column.

ARBOR No. 53 is furnished with the machine and No. 50 is sent on approval.

TABLE has a working surface of 15 by 61¾ inches. Length over all 68¼ inches. Has three ¾-in. T-slots, with oil pockets at end of table and oil grooves on sides.

ADJUSTMENTS are all furnished with movable handles—all movements are graduated and can be read to one-thousandth of an inch. The dials can be set to zero in any position.

FEEDS are positively driven through spur gears. There are sixteen changes, ranging from .003 to .129 for small mills; .010 to .448 for medium, and .037 to 1.60 for large mills. All feed changes are made by the two levers.

DIVIDING HEAD swings 15 inches and takes in 35 between centers. Spindle can be set 10 deg. below the horizontal each way.

DIFFERENTIAL INDEXING is provided and with the two index plates furnished all numbers to 360 can be spaced. Spirals from one turn in 1.55 inches to one turn in 137.14 can be cut.

FOOT STOCK has vertical adjustment with a screw, for taper work.

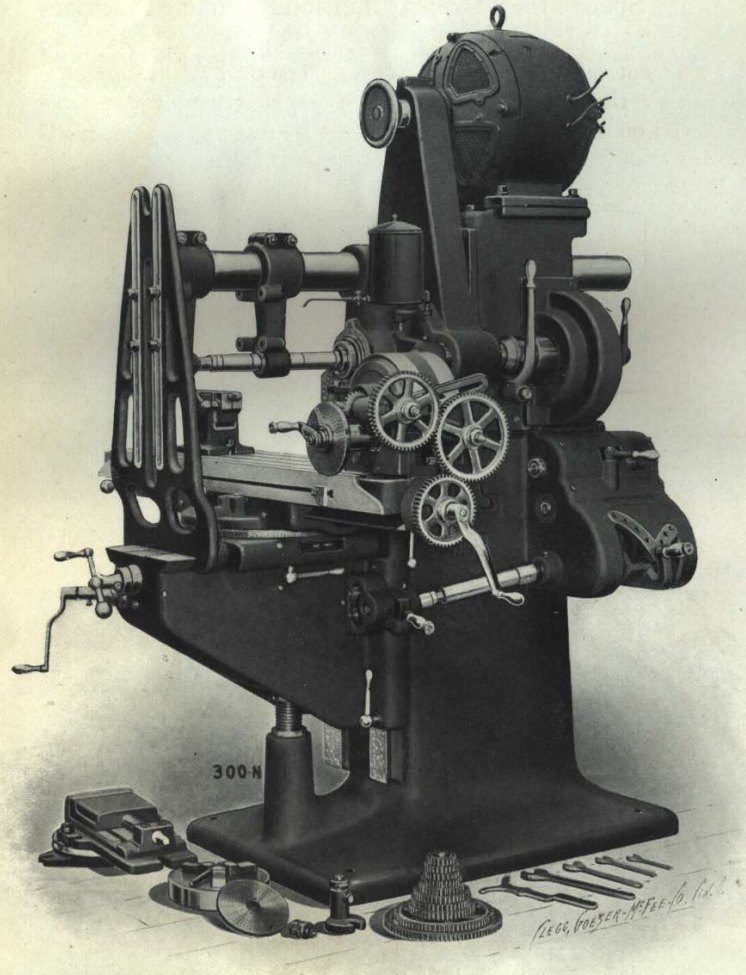
VISE. No. 4 Vise with swivel base is furnished with machine. It is 2½ inches deep, 8½ inches wide, and will take in 7 inches.

COUNTERSHAFT has double friction pulleys, 18 inches diameter, 5¼-inch face, and should run 185 and 230 revs. per minute.

FURNISHINGS include Oil Pot, Wrenches, Universal Chuck, Tables for spacing and cutting spirals, Countershaft, etc.

FLOOR SPACE, 109 inches in line with spindle, by 108 to take in full travel of table.

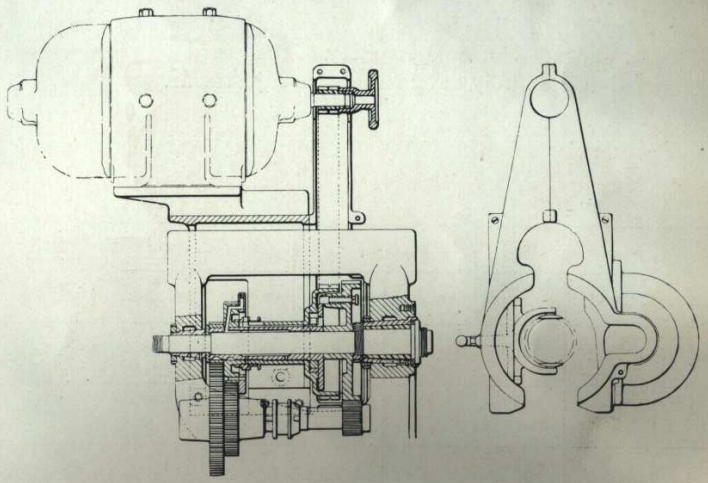
WEIGHT, Net, 7150 lbs.; shipping, 7700 lbs.; boxed, 8800 lbs.



No. 3 Variable Speed, Motor Driven

Variable Speed Motor Driven "LeBlond" Milling Machines

The cut on the opposite page and the outline drawing below show very clearly the construction and arrangement of the drive employed on our Milling Machines for connecting Variable Speed Motors.



MOTOR CONNECTION. The column is cast with pads, one on each side, which are planed to receive the motor housing or frame that supports the motor. A plate is inserted between the motor and the housing, which is made to fit the feet of the motor and the top of the motor housing. This gives a simple means of attaching any make of motor, rigidly and in a neat and workman-like manner.

SPINDLE DRIVE. The drive from the motor is with a Morse Silent Chain, which drives a gear loosely mounted on the spindle sleeve. The gear can be connected to the sleeve by means of a friction which is located in the recess of the gear and operated by a lever on the side of column. The sleeve can be locked to the face gear for direct speeds, or the drive can be had through the Double Friction Back-Gears. This arrangement gives three mechanical changes of speed to the spindle and in combination with a 3 to 1 variation on the motor, gives a continuous range of speeds from the maximum to the minimum, advancing by small increments.

SLEEVE FRICTION. The sleeve friction has two advantages over the ordinary motor drive construction: 1st, it provides means for quickly starting and stopping the machine independent of the motor. This is more convenient and rapid, as the momentum of the heavy armature does not have to be overcome and it gives a control to the drive as quick and sensitive as is obtained by the ordinary countershaft. 2d. Since the speed of the motor is not disturbed when the controller handle is once set, there is no question of maintaining the correct surface speed on the cutter throughout a given operation. The friction is very simple and consists of a ring which is expanded in the periphery of the gear by a taper wedge. This friction is entirely automatic in its adjustment.

SPINDLE SPEEDS AND GEAR RATIOS FOR VARIABLE SPEED MOTOR DRIVEN "LEBLOND" MILLING MACHINES.

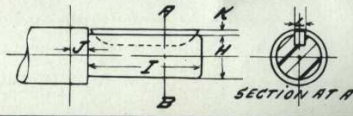
M.M.	Motor to Spindle		First Gear		Second Gear		Total Spindle Speeds
NO.	GR. RATIO	SPEEDS	RATIO	SPEEDS	RATIO	SPEEDS	RANGE
1½–2½	3.73–1	402 134	11.42–1	131 44	3–1	45 15	15–402
3	4.15–1	120 361	13.75–1	36 109	42.9–1	11.6 33.9	11.6–361
4	3.93–1	127 381	13.67–1	37 118	48.7–1	10 30	10–381

DOUBLE FRICTION BACK-GEARS. The "LeBlond" Double Friction Back-Gears are used in connection with all motor-driven Milling Machines. They give, with a lever, instantaneous speed changes, from high to low back-gear, without changing a gear and while the tool is running. The efficiency of this device on a motor-driven tool consists in giving a range of 40 speeds, varying from the smallest increment to a ratio of 1 to 9, without stopping the tool or changing any gears, pins, etc. It gives a continuous speed change with a 3 to 1 motor, and if the motor is operated on the multiple voltage system, it is seldom necessary to use the lower voltages.

No time or expense has been spared to provide our motor-driven Millers with every device that can increase their efficiency and ease in handling. The features we are using have been dictated by our experience of years of use with this style of drive in our own shops.

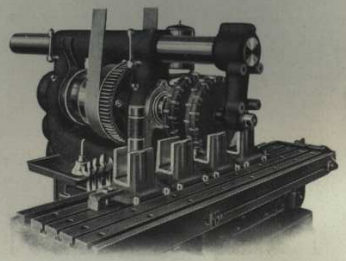
VARIABLE SPEED MOTORS. FOR LE BLOND MILLING MACHINES.
THE R. K. LE BLOND, MACH. TOOL CO. CINCINNATI, O. U.S.A.

SIZE OF MACHINE.	HORSE POWER OF MOTOR	SPEED RATIO	MAXIMUM SPEED RANGE	MOTOR SHAFT.
No. 1½ R & 2½ UNIV.	2	3-1	1500	B
No. 2½ P.	3	3-1	1500	B
No. 3 UNIV.	3	3-1	1500	C
No. 3 P.	5	3-1	1500	C
No. 4 UNIV.	5	3-1	1500	D
No. 4 P.	7½	3-1	1500	D



MOTOR SHAFT	H	I	J	K	L
B	1/8	3 1/8	1/4	1/8	1/4
C	1 3/8	3 3/8	1/4	3/16	3/8
D	1 5/8	4	1/4	3/16	3/8

On the opposite page we give a table showing all gear ratios and spindle speeds obtained on the various sized machines. We are prepared to attach any make of motor to our Milling Machines. The table above gives all necessary data for selecting motors—the horse power, speed ratio, and the diameter to which the motor shaft should be turned to receive the driving pinion.



"LeBlond" Heavy Duty Milling Machines.

On the following pages we illustrate and describe a line of extra heavy Milling Machines, designed for taking heavy cuts and fast feeds on work which admits of rapid milling. We have designated these "HEAVY DUTY," as indicating the service for which they are designed. These machines are built in sizes Nos. 3, 4 and 5 Plain and Nos. 3 and 4 Universal. The general characteristics of the design are: First, the massive construction of the machine throughout. Second, the powerful spindle drive, which is driven by a single pulley, running at a constant speed. Third, the all-geared feed, which can be driven either from the spindle to give feeds reading in thousandths per revolution, or from the constant speed shaft of the driving pulley to obtain feeds reading in inches per minute. Fourth, the ample provisions for supplying the cutters with lubricant. The design of the feeding mechanism in the knee, saddle and table, is extremely strong, and similar to the cone driven machines, except on the No. 5 Plain, which has the quick return to table, operated with hand wheel on the saddle.

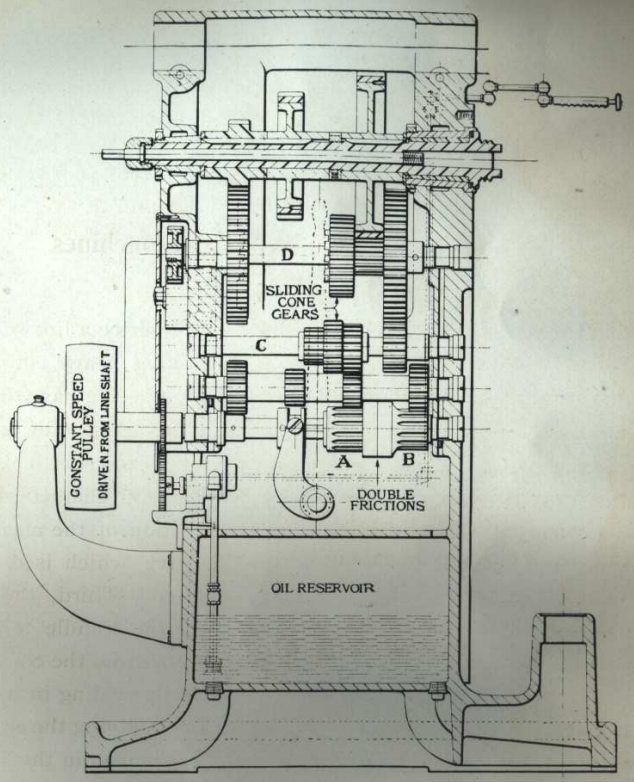


Fig. 1

General Description of the "LeBlond" Heavy Duty Miller.

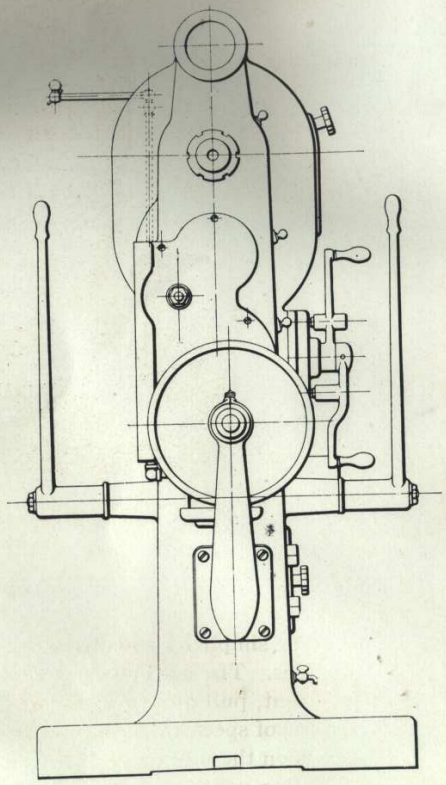
Manufactured under Patents Nos. 725,099 : 788,658 ; 845,005 ; 857,562.

MASSIVE CONSTRUCTION. The column, base and overarm support are cast in one piece and braced with cross ribs to insure rigidity. All gearing is encased in the column; this casing, which is cast integral with the column, connects the two spindle bearings and distributes additional metal around the spindle to absorb vibration. The lower compartment of the column and base form a reservoir for oil to supply the cutters with lubricant. The pleasing outlines characteristic of the "LeBlond" Milling Machines have been generally maintained throughout.

THE POWERFUL SPINDLE DRIVE. We use a constant speed or

all-geared drive as being best adapted for the heavy duty service for which these machines have been designed. On this drive we employ a single pulley of wide face and large diameter, running at a constant speed, giving high belt velocity and an abundance of power, the various speed changes being obtained entirely through gearing. This gives to the periphery of the cutter a constant torque or pull at a given surface speed, regardless of its diameter. All the speed changes are made with levers and any speed can be INSTANTLY OBTAINED WHILE THE MACHINE IS RUNNING.

THE CONSTRUCTION OF THE DRIVE. The arrangement of the gearing to obtain the speed changes will be understood by inspecting the line drawing, Fig. 1. It consists of a sliding gear transmission, of selective gear type, embodying the same principle as used on the better class of automobile construction, but designed to give 18 changes of speed.



The advantages of this drive for simplicity and durability have been thoroughly demonstrated and are universally understood. The hard service to which it has been subjected in automobile developement, has thoroughly tested it and established it beyond question as the most substantial, durable, easiest to handle, and best speed-changing device. For these reasons we have adopted it in preference to the yoke and drop gear speed change as used in a great many machine tools.

The constant speed driving pulley which can be belted direct from the line shafting, is mounted at the rear of the machine and is keyed to the driving shaft. This can be connected either to gear A or gear B, through the double frictions which are carried in the recessed flanges of the gears. This gives two changes of

speed to the spindle as well as means of quickly starting and stopping without shocks or jars. These frictions are of the well known "LeBlond" type and are automatic in adjustment. The intermediate shafts C and D each carry a set of sliding cone gears which further multiply the speeds, giving a total of 18 changes, varying in an almost exact geometric progression of 22½ per cent.

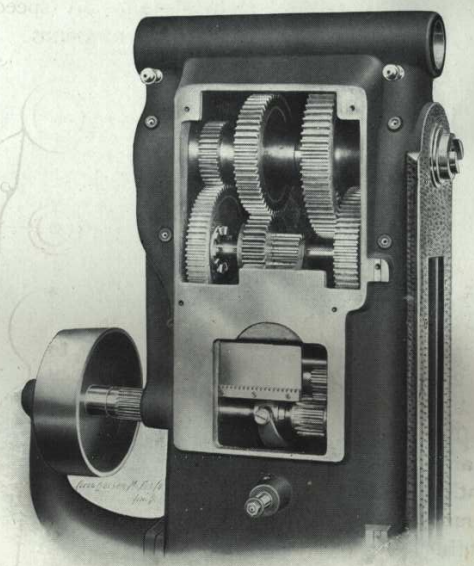


Fig. 2

The simplicity and strength of this drive are its principal advantages. The machine has no back-gears to throw in or out of engagement, pull pins or lock nuts to manipulate. This reduces the number of speed changing levers and simplifies the selection of the speeds on the index plate. It is also conspicuous by the absence of all sliding yokes and tumbler gears, locking levers, etc., subject to the strains due to heavy milling. The arrangement throughout is substantial and compact and the gearing is calculated for hard and continuous service. The illustration, Fig. 2, showing an exposed view of the interior of machine, gives a better idea of the strength

of the gearing. All gears are of exceptionally wide face and coarse pitch; they are made of steel, the teeth having beveled edges, and are hardened. Those running at high periphery speed are engaged with a clutch. Attention is called to the large diameter of the spindle driving gears, which in every case are larger than the cutter being driven, thus insuring a very smooth drive at all times.

THE SPEED CHANGING LEVERS AND METHOD OF OPERATING. Fig. 3 is an enlarged illustration showing that part of the machine carrying the speed changing levers. All speed changes are made by the three levers A, B and C, which are grouped together and located in the most convenient position for the operator. The long lever operates the double frictions and when placed in the central position, the spindle and all the gearing in the column are stationary. By moving the lever to the right or left, the machine is quickly started—smoothly and without shocks. This lever also gives two changes of speed. The length of this lever is such as to multiply the leverage 3½ times to the friction key, where it is again multiplied 15 times to the friction rings, giving a total leverage of more than 50 to 1. With this great leverage, only moderate pressure is required on the lever to operate the drive to its maximum capacity. The lever B operates the upper cone of sliding gears and gives coarse changes of speed in a ratio of 3.3 to 1. The lever C, operates the lower cone and gives fine changes of speed in a ratio of 1.75 to 1. Either lever can be moved independent of the other, depending on amount of speed change desired. The proper location of the levers to line up the gears correctly, is determined by snap plugs in the levers, which lock over the ball pointed studs in the column plate.

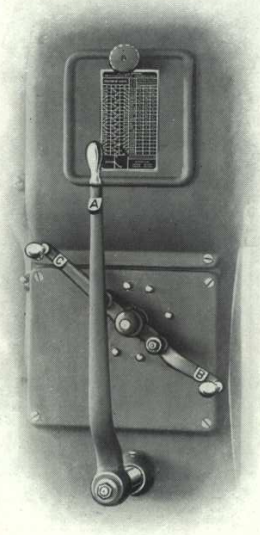
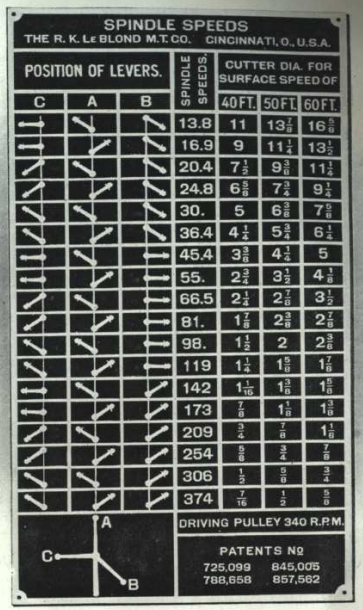


Fig. 3

In changing the speed, the long lever A, which operates the frictions, is thrown central, disengaging the drive. The spindle then slows down, and the sliding cone levers can be manipulated to bring the proper gears in engagement, and the machine is then started with the long lever, as usual.

SELECTING THE PROPER SPEED. As will be seen from Fig. 3, the speed


SPINDLE SPEEDS
THE R. K. LeBLOND M.T. CO. CINCINNATI, O., U.S.A.

POSITION OF LEVERS.			SPINDLE SPEEDS.	CUTTER DIA. FOR SURFACE SPEED OF		
C	A	B		40 FT.	50 FT.	60 FT.
			13.8	11	13 7/8	16 5/8
			16.9	9	11 1/4	13 1/2
			20.4	7 1/2	9 3/8	11 1/4
			24.8	6 5/8	7 3/4	9 1/4
			30.	5	6 3/8	7 5/8
			36.4	4 1/4	5 3/4	6 1/4
			45.4	3 3/8	4 1/4	5
			55.	2 3/4	3 1/2	4 1/8
			66.5	2 1/4	2 7/8	3 1/2
			81.	1 7/8	2 3/8	2 7/8
			98.	1 1/2	2	2 3/8
			119	1 1/4	1 5/8	1 7/8
			142	1 1/16	1 3/8	1 5/8
			173	7/8	1 1/8	1 3/8
			209	3/4	7/8	1 1/8
			254	5/8	3/4	7/8
			306	1/2	5/8	3/4
			374	7/16	1/2	5/8

A C B

DRIVING PULLEY 340 R.P.M.

PATENTS Nº
725,099 845,005
788,656 857,562

Fig. 4

index plate is attached to the cover on the machine in plain view of the operator. Fig. 4 is a photographic reproduction of this plate, in the middle column of which are indicated the 18 spindle speeds with which machine is provided. Immediately to the left the position of the levers for each speed is shown. This can be determined at a glance and the operator is not obliged to carry a series of letters and numbers in mind while making these changes. The index plate also gives the proper cutter diameter for surface speeds of 40, 50 and 60 feet per minute, from which the operator can determine at once the position of the levers to obtain the correct surface speed for the cutter. In making selections the spindle speed is entirely ignored, the operator merely selecting the surface speed required for the cutter, and opposite this can be seen at once the position of the levers. To illustrate, suppose we have a cutter 5 inches in diameter and wish to run at a surface speed of 40 feet per minute, read down the column under 40 feet and see that 5 appears in the fifth line, opposite which is indicated the position of the levers. Again, suppose we wish to run this cutter at 60 feet, read down the column under 60 feet and find the diameter of the cutter appears in th

seventh line, opposite which again are shown the lever positions. This table can be halved for 20, 25 and 30 feet, surface speed, and doubled for 80, 100 and 120 feet; in this way it is an easy matter to select the position of the levers for any surface speed for the cutter of from 20 to 120 feet. This is the simplest form of direct reading index plate.

MOTOR DRIVE. The Heavy Duty Milling Machines are exceptionally well adapted to be motor driven. Fig. 5 shows the motor application: the motor is supported by a bracket which is bolted to the finished pads on the column. The drive is through a raw hide pinion on the motor shaft to a spur gear which replaces the pulley on the driving shaft. This gives a silent spur gear drive and dispenses with the use of chains. Since all speed changes are obtained mechanically, a constant speed motor can be used which gives full efficiency at all times.

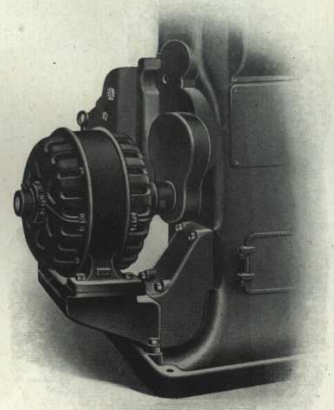


Fig. 5

Any make of motor can be attached, for a plate is inserted between the motor and bracket which is made to fit the feet on the motor and the bracket on the machine. This gives a simple means of attaching any type of motor, rigidly and in a neat and workman-like manner. We recommend a medium speed motor, for either A. C., or D. C. current, of horse power as given in specifications.

THE POSITIVE SPUR GEARED FEED. The design of the feed box is the same as that used on the cone-driven machines. This is a positive driven, all spur geared box and gives 16 changes of speed. It contains all the functions of feed changing within itself, see description page 10.

TWO TYPES OF FEED. We can furnish either one of two types of feed. Feeds reading in inches per minute, with 16 changes, ranging from $\frac{9}{16}$ to 25 inches table travel per minute: or, Feeds reading in thousandths per revolution of spindle, giving 48 changes ranging from .002 to .073 for small mills; .0055 to .235 for medium, and .017 to .750 for large mills. We are prepared to supply the type of feed selected by customer. Unless otherwise specified feeds reading in thousands per revolution are furnished.

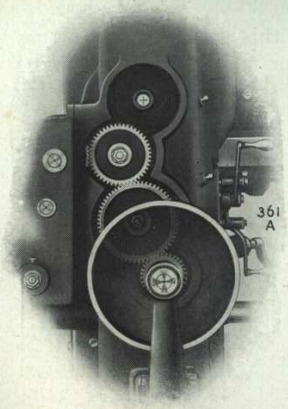


Fig. 6

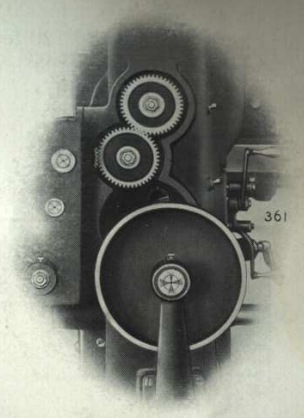


Fig. 8

FEED IN INCHES PER MINUTE;

In this case the feed box is driven from the driving pulley shaft as shown by Fig. 6. This is accomplished in the most simple and direct manner by two intermediate spur gears, avoiding the use of a chain. A slight modification is made in the machine, the friction is placed in the driving pulley and the double friction gears as regularly furnished are substituted by sliding gears. This gives a feed

FEED IN INCHES PER MINUTE. THE R. K. LE BLOND M.T. CO. CINCINNATI, O., U.S.A.								
LEVER. →	9/16	7/8	1 1/4	1 1/2	2	2 1/2	3	3 1/2
LEVER. ←	4 1/4	6 1/8	8 1/2	11 1/4	14 5/8	17 5/8	21 1/2	25

Fig. 7

to the table independent of the spindle speed, which therefore can be read in inches per minute. Fig. 7 shows the feed box index plate for this type of feed.

FEED PER REVOLUTION OF SPINDLE;

Fig. 8 shows the method of driving the feed box for feeds reading in thousandths per revolution of spindle. This is the type of feed which most operators are accustomed to use and is still gener-

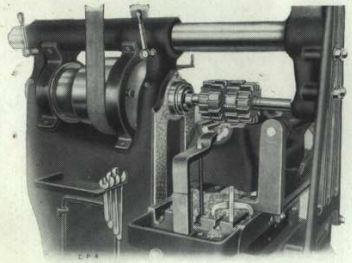
ally preferred. Our method of driving from the upper cone gear shaft, instead of direct from the spindle, makes this the best type of feeds for all kinds of milling, the drive being from a gear on the end of this shaft, proportions the feeds to the spindle speeds, gives 3 series of 16 changes each, for small, medium and large mills, or a total of 48 changes, ranging from .002 to .750 per revolution of spindle; and since the feed is proportioned to the spindle speed, the advantage is obtained of having fine feeds for small mills and

THE R. K. LE BLOND M.T. CO. — FEED INDEX PLATE. — CINCINNATI, O., U.S.A.

SPEED LEVERS	FEED LEVER	FEED PER REVOLUTION OF SPINDLE.							
		.002	.0025	.003	.0045	.006	.0075	.0085	.010
		.012	.017	.025	.033	.046	.053	.063	.073
		.005	.008	.010	.014	.018	.022	.026	.033
		.040	.054	.078	.105	.145	.165	.200	.235
		.017	.026	.035	.046	.058	.073	.088	.105
		.127	.182	.253	.340	.470	.526	.642	.750

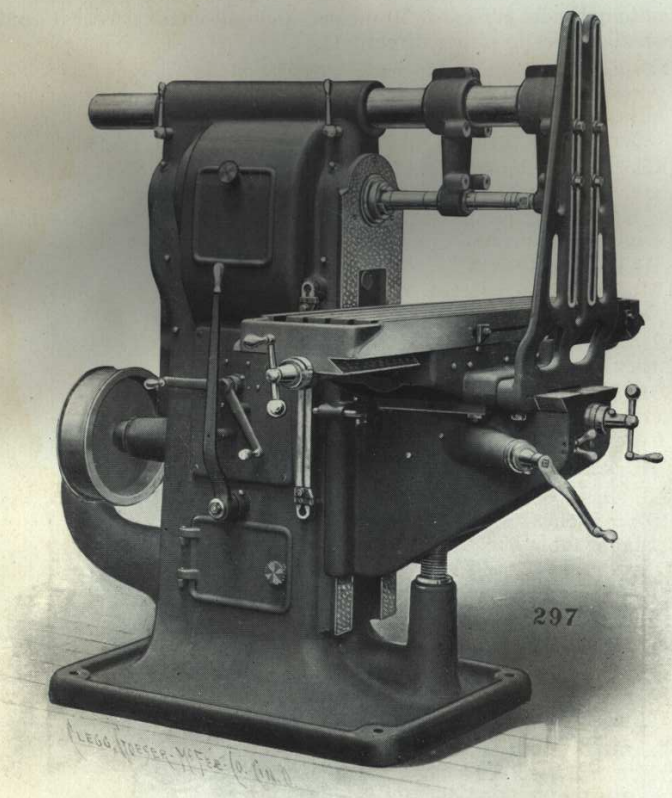
Fig. 9

coarse feeds for large mills. The feed box index plate is shown by Fig. 9. Making the feed changes is a very simple operation, since there are but two levers to operate, the upper lever is moved as indicated by the arrow mark and the lower handle thrown into the hole opposite the feed selected.



Dimensions "LeBlond" Heavy Duty Milling Machines.

SIZE OF MACHINE—	PLAIN			UNIVERSAL	
	No. 3	No. 4	No. 5	No. 3	No. 4
RANGE—automatic longitudinal feed	34	42	50	30	35
Automatic cross feed	10	12	12	10	12
" vertical feed	20	20	21	19	20
SPINDLE—size taper B. & S.	11	12	12	11	12
Diameter hole	1 1/16	1 3/16	1 3/16	1 1/16	1 3/16
" Nose	3 3/4	3 3/4	4	3 1/4	3 3/4
Threads per inch	5	4	4	5	4
DRIVE—Diameter Driving Pulley	14	16	18	14	16
Width of Belt	4	5	6	4	5
Speed	340	340	340	340	340
No. of Spindle Speeds	18	18	18	18	18
Range	13.8–374	13.8–374	13.8–374	13.8–374	13.8–374
MOTOR—H.P. recommended	7½	10	15	7½	10
OVERARM—					
Greatest dist. bet. Column and Brace	26	29	36	26	29
" to center of Spindle	7 3/8	8 1/4	8 3/4	7 3/8	8 1/4
TABLE—Working surface	13½x53¾	16¼x67	20x72	12x52¾	15x61¾
Length over all	63	73¾	81	57½	68¼
Size T-slots	5/8	3/4	3/4	5/8	3/4
FEEDS—Number of, in Thousandths	48	48	48	48	48
Number of, in Inches	16	16	16	16	16
Range of, in Thousandths	.002–.750	.002–.750	.002–.750	.002–.750	.002–.750
" in Inches	1/8–25	1/8–25	1/8–25	1/8–25	1/8–25
WEIGHT—Net LBS	5250	7400	9250	5700	7520
Shipping LBS	5700	7800	10000	6050	8000
Boxed LBS	6250	8800	10700	7000	9300



No. 3 Heavy Duty Plain

No. 3 "LeBlond" Heavy Duty Plain Milling Machine.

RANGE. This machine has automatic feed to table of 34 inches, automatic cross feed of 10 inches, and automatic vertical feed of 20 inches in either direction.

SPINDLE. Front journal is made tapering, is $3\frac{1}{8}$ inches diameter, hardened and ground. It has adjustment for wear and perfect oiling facilities. Front end is threaded and has No. 11 B. & S. taper. Hole through spindle is $1\frac{1}{16}$ inch in diameter.

DRIVE. Pulley runs at constant speed of 340 revolutions per minute; is 14 inches diameter, for 4-in. belt; there are 18 spindle speeds, ranging in geometric progression from 13.8 to 374. Highest gear ratio 25 to 1; lowest .91 to 1. Speed changes are made with levers.

MOTOR-DRIVE. Constant speed motor 7½ H. P. of medium speed recommended.

OVER-ARM is a solid bar of steel, furnished with two arbor supports, one for supporting end the other the middle of arbor.

ARBOR BRACE is furnished for connecting the arbor support with knee, and when set in the extreme position will be 26 inches from face of column.

ARBOR is not furnished, but Nos. 40 and 45 are sent on approval.

TABLE, has working surface of 13½ by 58¼ inches. Length over all 63 inches. Has three ⅝-inch T-slots with oil pockets at ends of table and oil grooves on side.

ADJUSTMENTS are all supplied with movable handles. All movements are graduated and can be read to one-thousandth of an inch. Dials can be set to zero in any position.

FEEDS are positively driven through spur gears. There are forty-eight changes, ranging from .002 to .073 for small mills; .0055 to .235 for medium and .017 to .750 for large mills. All feed changes are made with two levers.

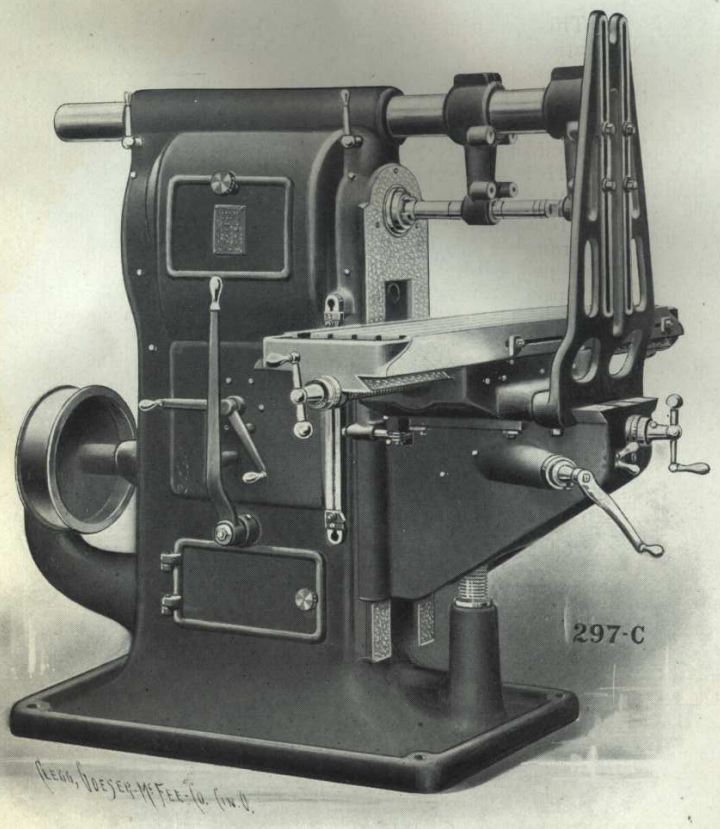
VISE, No. 3 Plain is furnished with the machine; it is $1\frac{5}{8}$ inches deep, 7¼ inches wide and takes in 5 inches.

COUNTERSHAFT. A single speed, tight and loose pulley countershaft is furnished, pulleys 16 inches diameter, 4¾ inch face. Machine can be driven from countershaft or direct from line shafting.

FURNISHINGS, include Oil Pot, Wrenches, Countershaft, etc.

FLOOR SPACE, 95 inches in line with spindle, by 115 inches to take in full travel of table.

WEIGHT, Net, 5250 lbs.; shipping, 5700 lbs.; boxed, 6250 lbs.



No. 4 Heavy Duty Plain

No. 4 "LeBlond" Heavy Duty Plain Milling Machine.

RANGE. This machine has automatic feed to table of 42 inches, automatic cross feed of 12 inches, and automatic vertical feed of 20 inches in either direction.

SPINDLE. Front journal is made tapering, is 4⅛ inches diameter, hardened and ground. It has adjustment for wear and perfect oiling facilities. Front end is threaded and has No. 12 B.& S. taper. Hole through spindle is $1\frac{3}{16}$ inch in diameter.

DRIVE. Pulley runs at constant speed of 340 revolutions per minute; is 16 inches diameter, for 5-inch belt; there are 18 spindle speeds, ranging in geometric progression from 13.8 to 374 revolutions per minute. Highest gear ratio 25 to 1; lowest .91 to 1. Speed changes are made with levers.

MOTOR DRIVE. Constant speed motor 10 H. P. of medium speed recommended.

OVER-ARM is a solid bar of steel, furnished with two arbor supports, one for supporting end the other the middle of arbor.

ARBOR BRACE is furnished for connecting the arbor support with knee and when set in the extreme position will be 29 inches from face of column.

ARBOR is not furnished, but Nos. 50 and 55A are sent on approval.

TABLE has working surface of 16¼ by 67 inches. Length over all 73¾ inches. Has three ¾-inch T-slots, with oil pockets at ends of table and oil grooves on side.

ADJUSTMENTS are all supplied with movable handles. All movements are graduated and can be read to one-thousandth of an inch. Dials can be set to zero in any position.

FEEDS are positively driven through spur gears. There are forty-eight changes, ranging from .002 to .073 for small mills; .0055 to .235 for medium, and .017 to .750 for large mills. All feed changes are made with two levers.

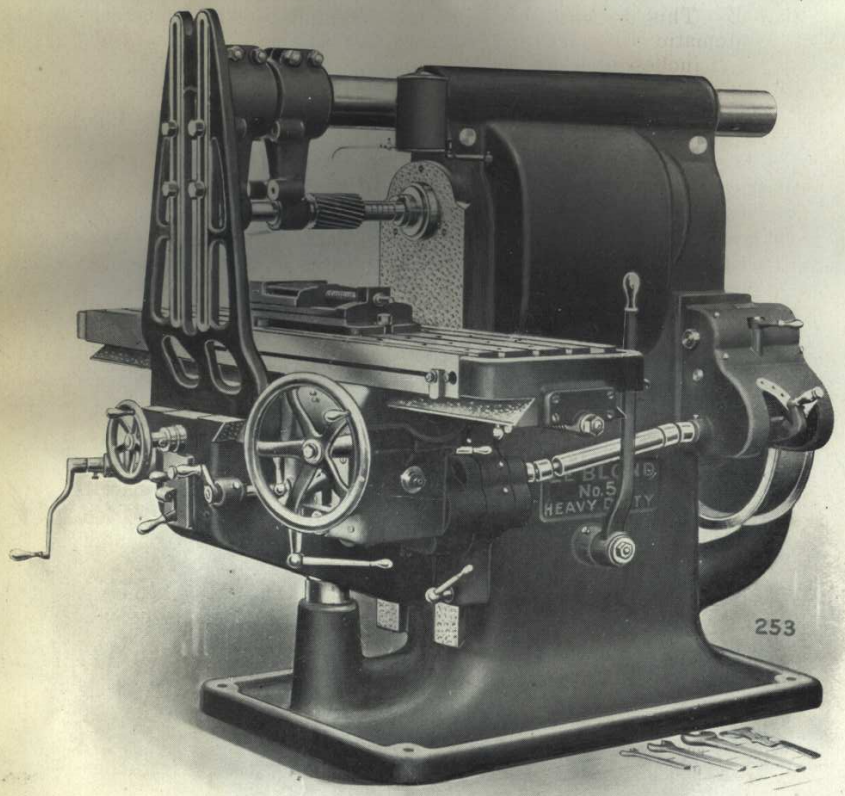
VISE, No. 4 Plain is furnished with the machine; it is 2½ inches deep, 8½ inches wide, and takes in 7 inches.

COUNTERSHAFT. A single speed, tight and loose pulley countershaft is furnished, pulleys 18 inches diameter, 5¾ inches face. Machine can be driven from countershaft or direct from line shafting.

FURNISHINGS include Oil Pot, Wrenches, Countershaft, etc.

FLOOR SPACE, 109 inches in line with spindle, by 138 inches to take in full travel of table.

WEIGHT, Net, 7400 lbs.; shipping, 7800 lbs.; boxed, 8800 lbs.



No. 5 Heavy Duty Plain

No. 5 "LeBlond" Heavy Duty Plain Milling Machine.

RANGE. This machine has automatic feed to table of 50 inches, automatic cross feed of 12 inches, and automatic vertical feed of 21 inches in either direction.

SPINDLE. Front journal is made tapering, is 4½ inches diameter, hardened and ground. It has adjustment for wear and perfect oiling facilities. Front end is threaded and has No. 12 B.& S. taper. Hole through spindle is $1\frac{3}{16}$ inch diameter.

DRIVE. Pulley runs at constant speed of 340 revolutions per minute; is 18 inches diameter, for 6-in. belt; there are 18 spindle speeds, ranging in geometric progression from 13.8 to 374. Highest gear ratio is 25 to 1; lowest, .91 to 1. Speed changes are made with levers.

MOTOR-DRIVE. Constant speed motor, 15 H. P. of medium speed recommended.

OVER ARM is solid bar of steel, furnished with two arbor supports, one for supporting end the other the middle of arbor.

ARBOR BRACE is furnished for connecting arbor support with knee and when set in the extreme position will be 36 inches from face of column.

ARBOR is not furnished, but Nos. 53 and 59 are sent on approval.

TABLE, has working surface of 20 by 72 inches. Length over all 81 inches. Has four ¾-inch T-slots, with oil pockets at ends of table and oil grooves on side.

ADJUSTMENTS are all supplied with hand wheels. All movements are graduated and can be read to one-thousandth of an inch. Dials can be set to zero in any position.

FEEDS are positively driven through spur gears. There are forty-eight changes, ranging from .002 to .073 for small mills; .0055 to .235 for medium and .017 to .750 for large mills. All feed changes are made with two levers.

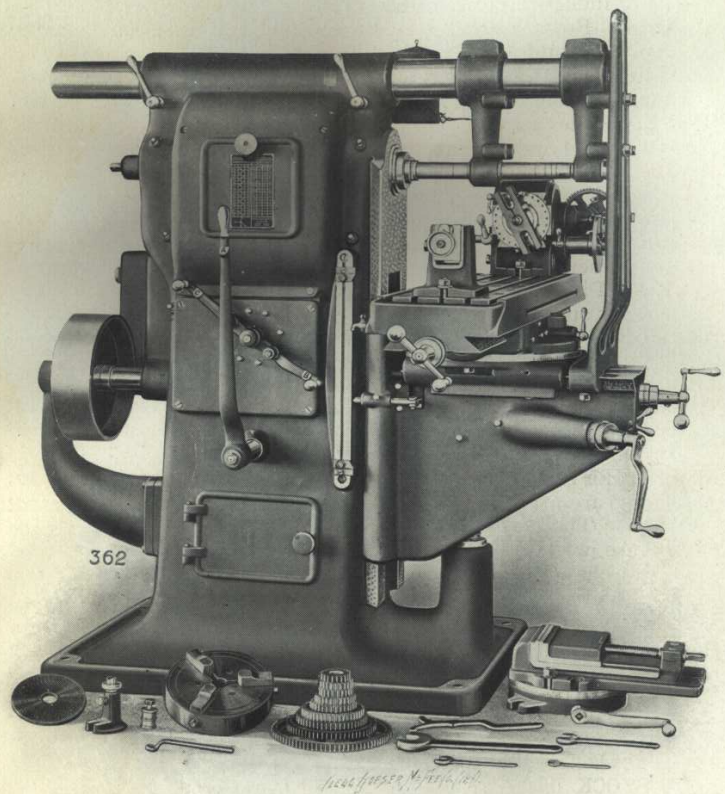
VISE, No. 4 Plain is furnished with the machine; it is 2½ inches deep, 8½ inches wide and takes in 7 inches.

COUNTERSHAFT. A single speed, tight and loose pulley countershaft is furnished, pulleys 20 inches diameter, 6½ inch face. Machine can be driven from countershaft or direct from line shafting.

FURNISHINGS include Oil Pot, Wrenches, Countershaft, etc.

FLOOR SPACE, 109 inches in line with spindle, by 138 to take in full travel of table.

WEIGHT, Net, 9250 lbs.; shipping, 10,000 lbs.; boxed, 10,700 lbs.



No. 3 Heavy Duty Universal

No. 3 "LeBlond" Heavy Duty Universal Milling Machine.

RANGE. This machine has automatic feed to table of 30 inches, automatic cross feed of 10 inches, and automatic vertical feed of 19 inches in either direction.

SPINDLE. Front journal is made tapering, is $3\frac{3}{16}$ inches diameter, hardened and ground. It has adjustment for wear and perfect oiling facilities. Front end is threaded and has No. 11 B.& S. taper. Hole in spindle is $1\frac{1}{16}$ inch in diameter.

DRIVE. Pulley runs at constant speed of 340 revolutions per minute; is 14 inches diameter, for 4-inch belt: there are 18 spindle speeds, ranging in geometric progression from 13.8 to 374. Highest gear ratio 25 to 1; lowest, .91 to 1. Speed changes are made with levers.

MOTOR DRIVE. Constant speed motor 7½ H. P. of medium speed recommended.

OVER-ARM is solid bar of steel, furnished with two arbor supports, one for supporting end the other the middle of arbor.

ARBOR BRACE is furnished, and when in the extreme position will be 26 inches from face of column.

ARBOR No. 40 is sent with machine and No. 45 is sent on approval.

TABLE has working surface of 12 by 52¾ inches. Length over all 57½ inches. Has three ⅝-inch T-slots with oil pockets at end of table and oil grooves on sides.

ADJUSTMENTS are all supplied with movable handles. All movements are graduated and can be read to one-thousandth of an inch. The Dial can be set to zero in any position.

FEEDS are positively driven through spur gears. There are forty-eight changes, ranging from .002 to .073 for small mills; .0055 to .235 for medium and .017 to .750 for large mills. All feed changes are made by two levers.

DIVIDING HEAD swings 12¼ inches and takes 30½ between centers. Spindle can be set 10 degrees below the horizontal each way.

INDEX PLATES. Two are furnished and will divide all numbers to 50, all even numbers to 100 and most numbers to 360. Spirals from one turn in 1.55 inches to one turn in 137.14 can be cut. Differential Indexing can be furnished.

FOOT STOCK has vertical adjustment with a screw for taper work.

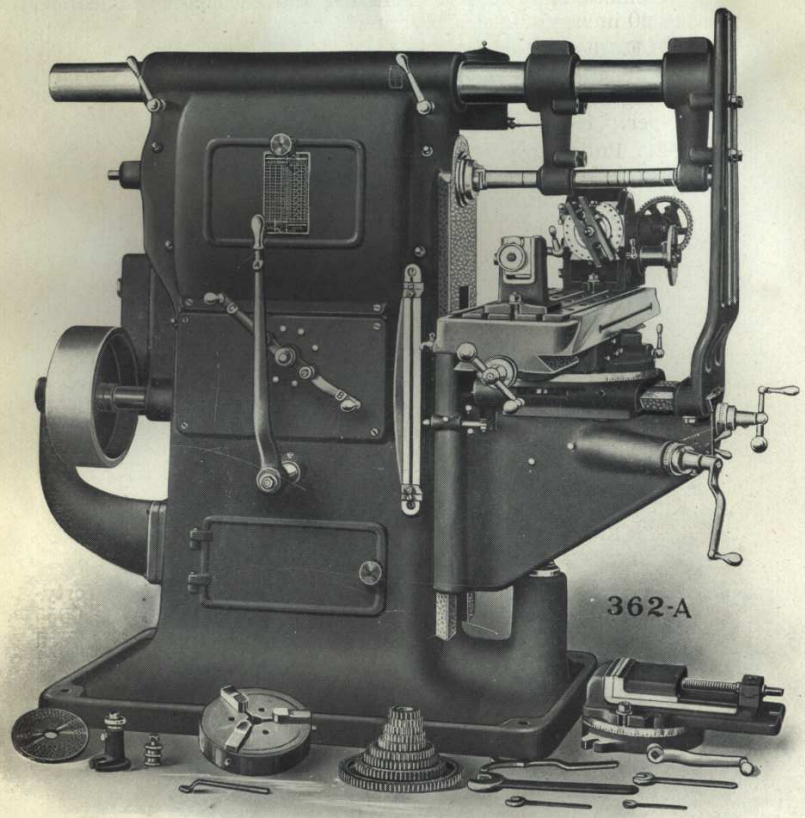
VISE, No. 3, with swivel base, is furnished with machine; it is $1\frac{5}{16}$ inches deep, 7¼ inches wide and takes in 5 inches.

COUNTERSHAFT. A single speed, tight and loose pulley countershaft is furnished, pulleys 16 inches diameter, 4¾ inches face. Machine can be driven from countershaft or direct from line shafting.

FURNISHINGS, include Oil Pot, Universal Chuck, Tables for spacing and cutting Spirals, Wrenches, Countershaft, etc.

FLOOR SPACE, 95 inches in line with spindle, by 106 inches to take in full travel of table.

WEIGHT, Net, 5790 lbs.; shipping, 6050 lbs.; boxed, 7000 lbs.



No. 4 Heavy Duty Universal.

No. 4 "LeBlond" Heavy Duty Universal Milling Machine.

RANGE. This machine has automatic feed to table of 35 inches, automatic cross feed of 12 inches, and automatic vertical feed of 20 inches in either direction.

SPINDLE. Front journal is made tapering, is 4⅛ inches diameter, hardened and ground. It has adjustment for wear and perfect oiling facilities. Front end is threaded and has No. 12 B.& S. taper. Hole through spindle is $1\frac{3}{16}$ inch diameter.

DRIVE. Pulley runs at constant speed of 340 revolutions per minute; is 16 inches in diameter for 5-in. belt; there are 18 spindle speeds, ranging in geometric progression from 13.8 to 374. Highest gear ratio 25 to 1; lowest, .91 to 1. Speed changes are made with levers.

MOTOR DRIVE. Constant speed motor 10 H. P. of medium speed recommended.

OVER-ARM is solid bar of steel, furnished with two arbor supports, one for supporting end the other the middle of arbor.

ARBOR BRACE is furnished and when in the extreme position will be 29 inches from face of column.

ARBOR No. 50 is furnished and No. 55A is sent on approval.

TABLE has a working surface of 15 by 61¾ inches. Length over all 68¼ inches. Has three ¾-inch T-slots with oil pockets at end of table and oil grooves on sides.

ADJUSTMENTS are all supplied with movable handles. All movements are graduated and can be read to one-thousandth of an inch. The Dial can be set to zero in any position.

FEEDS are positively driven through spur gears. There are 48 changes, ranging from .002 to .73 for small mills; 0055 to .234 for medium, and .017 to .750 for large mills. All feed changes are made by two levers.

DIVIDING HEAD swings 15 inches and takes in 35 between centers. Spindle can be set 10 deg. below the horizontal each way.

DIFFERENTIAL INDEXING is provided and with the two index plates furnished, all numbers to 360 can be spaced. Spirals from one turn in 1.55 inches to one turn in 137.14 can be cut.

FOOT STOCK has vertical adjustment with a screw for taper work.

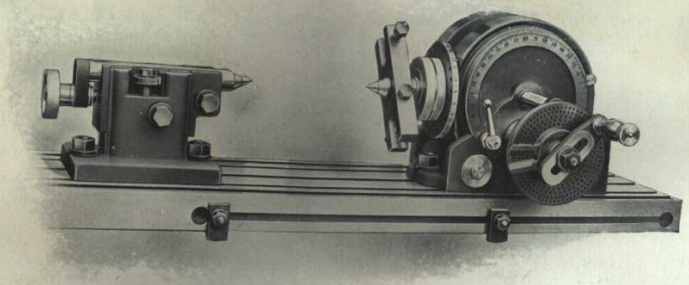
VISE, No. 4 with swivel base is furnished with machine; it is 2½ inches deep, 8½ inches wide and will take in 7 inches.

COUNTERSHAFT. Single speed, tight and loose pulley countershaft is furnished, pulleys 18 in. diameter, 5¾ in. face. Machine can be driven from countershaft or direct from line shafting.

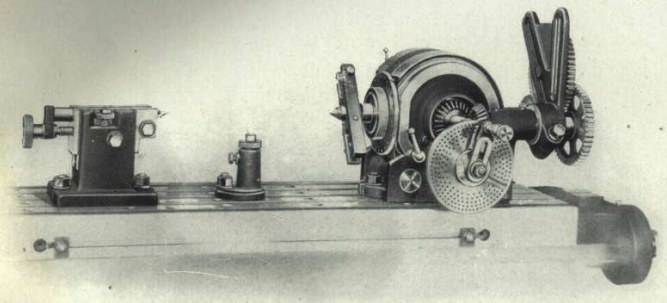
FURNISHINGS, include Oil Pot, Universal Chuck, Tables for spacing and cutting spirals, Wrenches, Countershaft, etc.

FLOOR SPACE, 109 inches in line with spindle by 108 inches to take in full travel of table.

WEIGHT, Net, 7520 lbs.; shipping, 8000 lbs.; boxed, 9300 lbs.



Universal Dividing Head.



WITH QUADRANT AND CHANGE GEARS, ETC., FOR CUTTING SPIRALS

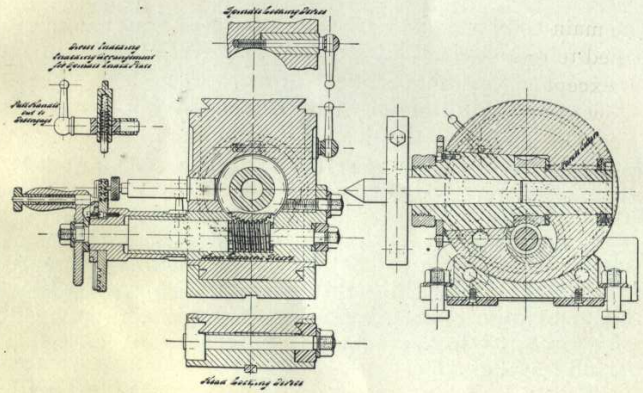
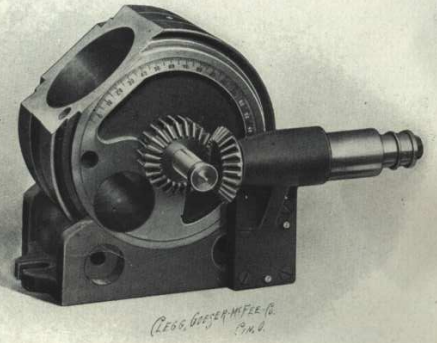


DIAGRAM UNIVERSAL DIVIDING HEAD.

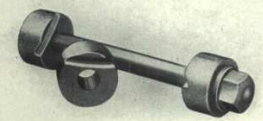
"LeBlond" Universal Dividing Head.

Code word. 10-in. QUART. 12-in. QUASH. 15-in. QUATTLE.
When ordering give size and number of machine as stamped on face of table.

The cuts and diagram opposite represent our Universal Dividing Head, regularly furnished on our Universal Machines, and as its name implies is a universal head in all respects—all kinds of dividing at any angle, or spirals of any form can be cut on it. It is made in three sizes, to swing 10¼, 12½ and 15 inches. Swivel can be turned completely over from one side to the other and to 10 degrees below the horizontal on either side, describing an arc of 200 degrees. It is not necessary to remove any part of the head to secure this range.



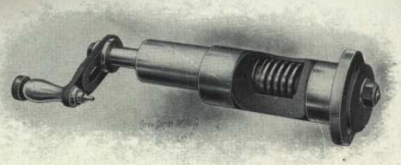
The main body or swivel of the head is one solid casting, bored and turned to receive the different parts. It is completely circular in form except at the front spindle bearing. This is cut back so as to allow as great a distance as possible between the centers and reduce the height when set in a vertical position. A dovetail is turned completely around the swivel for clamping it to the base. The base is accurately turned to fit the swivel, both ends and the main body of swivel forming a bearing which is securely clamped to the base by clamping bolts, the heads of these being turned the exact radius of the dovetail in swivel.



The base is carefully reamed to fit the body and head of bolt, so that

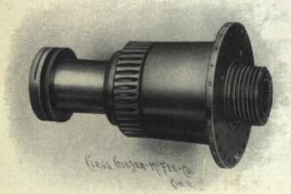
when the nuts are tightened they draw the circular piece down, clamping it securely to the base, besides locking it in position and making it absolutely rigid.

The base carries a bracket which supports the quadrant carrying the change gears that connect the spindle with the table feed screw. The connection can be made with either simple or compound gearing, giving an extremely large range of spirals either right or left hand. The motion is transmitted to a bevel gear running on a stud in the center of the swivel, so that swiveling the head does not change the position of the gear. Connected directly to this bevel is a spur gear which drives a gear on the index plate sleeve.



The worm and its shaft are made in one piece which is carried in an eccentric sleeve so that it can always be kept in proper contact with the worm wheel. This sleeve has a circular slot at the rear end and is provided with a stop screw, so that when the worm is once adjusted to the worm wheel it can be thrown out and brought back to its original position without any readjustment. The end thrust of the worm is taken on two hardened and ground collars. The eccentric is so arranged that at the correct point of engagement the movement of the worm is absolutely at right angles to the spindle.

The spindle is made of tool steel. The thrust is taken up by two hardened and ground thrust collars. Front journal is made very large so that the wear will be imperceptible, and is tapering to admit of adjustment.



The dividing wheel is made of phosphor bronze, accurately cut with a special machine designed for this purpose. The spindle is threaded and bored the same as the main spindle of the milling machine. A plate having twenty-four divisions is fitted to the front of spindle for quick indexing. The worm wheel can be quickly disconnected and the divisions made by this plate. This is especially useful for square and hexagon pieces, taps, reamers and like work. The index pin for these divisions has a rack cut in it and is operated by a small pinion lever.

A spiral spring is placed behind the rack to keep it against the front plate. When not in use the lever is thrown back and drawn forward, locking the index pin, so that it cannot interfere with indexing in the regular manner through worm. The spindle is locked by a locking plug which fits into the main body of the head and is bored with the swivel casting, forming a perfect fit on the section of the spindle, this is forced in against the spindle by a screw making a very rigid lock.



The simplicity of this head is its great advantage; all adjustments are on the outside and can be made with standard wrenches, the main parts can be taken off and replaced in two minutes.

To remove the spindle, take off the rear adjusting nut, drop the eccentric so worm wheel clears and the spindle can be removed.

Taking off index plate, removing the nut holding the eccentric the worm and sleeve can be removed. The foot stock block is provided with a vertical adjustment, this adjustment is made with a screw and can be adjusted to a nicety, and clamped in position. The front of this adjusting block is split and can be securely drawn together, locking the center which it carries. This center is a plain lathe job and can be renewed by any lathe hand, it requiring no special fixtures or accurate face plate work to repoint.



Two index plates are regularly furnished with holes drilled on both sides, as follows:

"A" Plate—1st side:	**34**	**39**	**46**	**51**	**58**
2d side:	**36**	**41**	**47**	**53**	**60**
"B" Plate—1st side:	**37**	**42**	**48**	**54**	**62**
2d side:	**38**	**43**	**49**	**56**	**66**

With these plates all numbers to 58, even numbers to 100, and many numbers to 360 can be spaced. Change gears are furnished for cutting a complete range of spirals, from 1.55 to 137.14 lead. A complete set of index tables are furnished in connection with this head, for spacing and cutting spirals.



This Head can be furnished with or without Quadrant.

Specifications Universal Dividing Head.

Size of Head.	Machine where regularly furnished.	Swing.	Taper in Spindle. B. & S.	Spindle Nose Diameter.	Length of Head and Foot Stock combined.	WEIGHT.	
						With Quadrant & ch. gear	Without Quadrant and Change Gear
10-in.	No. 1	10¼"	No. 10	3"x5 thd	21¾"	205	160
10-in.	No. 1½	10¼"	No. 10	3"x5 thd	21¾"	205	160
10-in.	No. 2	10¼"	No. 10	3"x5 thd	21¾"	205	160
10-in.	No. 2½	10¼"	No. 10	3"x5 thd	21¾"	205	160
12-in.	No. 3	12½"	No. 11	3¼"x4 thd	22½"	285	230
15-in.	No. 4	15"	No. 12	3¾"x4 thd	26½"	410	330

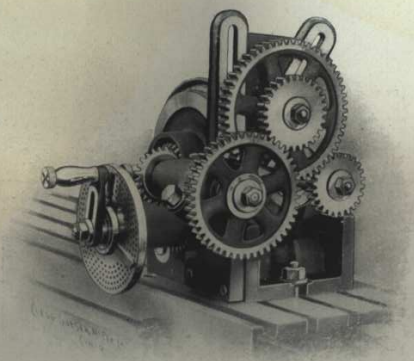
Table of Spacing on Dividing Head.

NO. TEETH	CIRCLE	TURNS	HOLES	NO. TEETH	CIRCLE	HOLES	NO. TEETH	CIRCLE	HOLES	NO. TEETH	CIRCLE	HOLES
2	ANY	20	—	41	41	40	94	47	20	185	37	8
3	66	13	22	42	42	40	95	38	16	188	47	10
4	ANY	10	—	43	43	40	96	48	20	190	38	8
5	ANY	8	—	44	66	60	98	49	20	192	48	10
6	66	6	44	45	54	48	100	60	24	195	39	8
7	56	5	40	46	46	40	102	51	20	196	49	10
8	ANY	5	—	47	47	40	104	39	15	200	60	12
9	54	4	24	48	48	40	105	42	16	204	51	10
10	ANY	4	—	49	49	40	106	53	20	205	41	8
11	66	3	42	50	60	48	108	54	20	210	42	8
12	48	3	16	51	51	40	110	66	24	212	53	10
13	39	3	3	52	39	30	112	56	20	215	43	8
14	49	2	42	53	53	40	115	46	16	216	54	10
15	66	2	44	54	54	40	116	58	20	220	66	12
16	48	2	24	55	66	48	120	66	22	224	56	10
17	34	2	12	56	56	40	124	62	20	230	46	8
18	54	2	12	58	58	40	130	39	12	232	58	10
19	38	2	4	60	42	28	132	66	20	235	47	8
20	ANY	2	—	62	62	40	135	54	16	240	66	11
21	42	1	38	64	48	30	136	34	10	245	49	8
22	66	1	54	65	39	24	140	56	16	248	62	10
23	46	1	34	66	66	40	144	54	15	260	39	6
24	48	1	32	68	34	20	145	58	16	264	66	10
25	60	1	36	70	56	32	148	37	10	270	54	8
26	39	1	21	72	54	30	150	60	16	272	34	5
27	54	1	26	74	37	20	152	38	10	280	56	8
28	42	1	18	75	60	32	155	62	16	290	58	8
29	58	1	22	76	38	20	156	39	10	296	37	5
30	48	1	16	78	39	20	160	56	14	300	60	8
31	62	1	18	80	34	17	164	41	10	310	62	8
32	56	1	14	82	41	20	165	66	16	312	39	5
33	66	1	14	84	42	20	168	42	10	320	48	6
34	34	1	6	85	34	16	170	34	8	328	41	5
35	56	1	8	86	43	20	172	43	10	330	66	8
36	54	1	6	88	66	30	176	66	15	340	51	6
37	37	1	3	90	54	24	180	54	12	344	43	5
38	38	1	2	92	46	20	184	46	10	360	54	6
39	39	1	1									
40	ANY	1	—									

Special Divisions,

NOT OBTAINABLE WITH THE PLATES REGULARLY FURNISHED WITH THE INDEXING AND DIVIDING HEAD.

NUMBER OF DIVISIONS	CIRCLE	HOLES	NUMBER OF DIVISIONS	CIRCLE	HOLES
57	57	40	244	61	10
59	59	40	252	63	10
61	61	40	254	127	20
63	63	40	268	67	10
67	67	40	276	69	10
69	69	40	284	71	10
71	71	40	285	57	8
73	73	40	292	73	10
77	77	40	295	59	8
79	79	40	305	61	8
81	81	40	308	77	10
83	83	40	315	63	8
87	87	40	316	79	10
89	89	40	324	81	10
91	91	40	332	83	10
93	93	40	335	67	8
97	97	40	345	69	8
99	99	40	348	87	10
103	103	40	355	71	8
114	57	20	356	89	10
118	59	20	364	91	10
122	61	20	365	70	8
126	63	20	372	93	10
127	127	40	385	77	8
134	67	20	388	97	10
138	69	20	395	79	8
142	71	20	396	99	10
146	73	20	405	81	8
154	77	20	412	103	10
158	79	20	415	83	8
162	81	20	435	87	8
166	83	20	445	89	8
174	87	20	456	57	5
178	89	20	465	93	8
182	91	20	472	59	5
186	93	20	485	97	8
194	97	20	488	61	5
198	99	20	495	99	8
206	103	20	504	63	5
228	57	10	508	127	10
236	59	10	515	103	8



Differential Indexing Device.

Code word, QUIFFEREN.

The Differential Indexing Device consists in arranging the dividing head so that the spindle and index plate may be connected together and driven by change gears, by this means all divisions up to 360 are obtainable. The head is furnished with a bracket, quadrant and change gears, same as used for spiral cutting, and the end of spindle is bored tapering to receive a plug or stud for carrying the spindle change gears. This device can be used only when the head is set in the horizontal position.

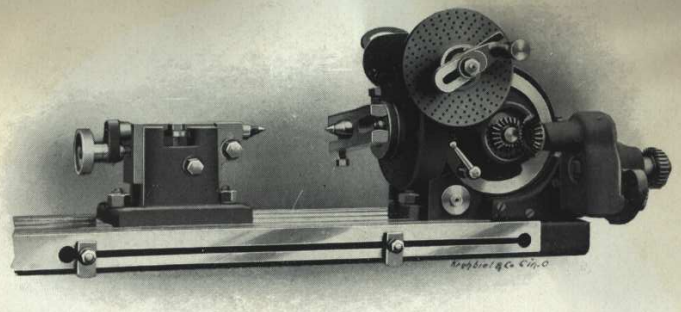
Special Index Plates.

When ordering give size of Head on which Plates are to be used.

Index Plates for spacing odd divisions can be furnished, these together with plates regularly furnished, give all divisions to 100, and many other divisions. Table on preceding page gives all extra divisions obtainable. Two plates are required, drilled on both sides, as follows:

"C" Plate—1st side:	**61**	**71**	**81**	**91**	**127**
2d side:	**57**	**67**	**77**	**87**	**97**
"D" Plate—1st side:	**63**	**73**	**83**	**93**	**103**
2d side:	**59**	**69**	**79**	**89**	**99**

A special index handle and pin is furnished to fit the small diameters of holes with which the plate is drilled. Plates, drilled with any special number of holes, are made to order.



"LeBlond" Special Dividing Head,

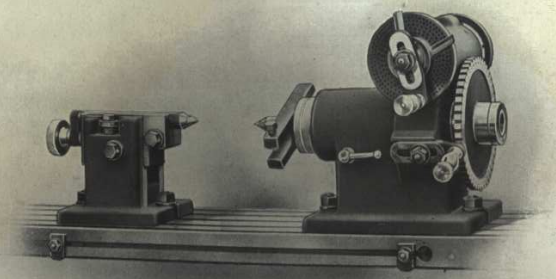
FOR SPIRAL CUTTING.

This head possesses all the features of the Universal Dividing Head described on page 73. The worm wheel is carried at the end of the spindle, next to the nose. This construction permits the wheel to be made exceptionally large in diameter, and makes the head well adapted for cutting spirals. The diameter of this wheel, which is 6.684 inches, insures this head maintaining its accuracy indefinitely. The head can be swiveled in a vertical plane from 10 degs. below the horizontal to 10 degs. beyond the vertical. The worm and worm wheel are carried in a dust proof casing which gives perfect protection to these parts when the head is in any position. The head is furnished with direct and worm indexing; all low numbered divisions are made by a locking pin engaging directly into the worm wheel. Two worm index plates are furnished, these are drilled and admit of same divisions being made as on the Universal Head, these are given on page 76.

Change gears are furnished for cutting a complete range of spirals, from 1.55 to 137.14 lead. A set of index tables is furnished in connection with this head for spacing and cutting spirals. Special index plate and differential indexing, as described on page 78, can be furnished if desired.

SPECIFICATIONS.

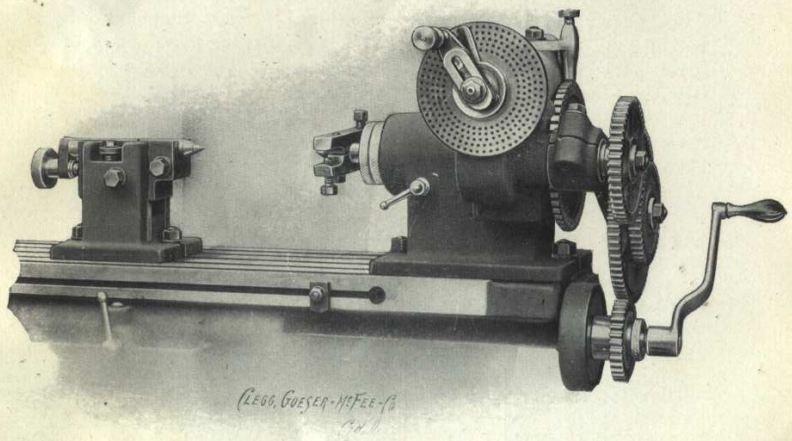
Size of Head	Machine where used.	Swing	Taper in Spindle B. & S.	Spindle Nose Diameter	Length of Head and Foot Stock combined	Weight
10″	No. 1	10¼″	No. 10	3″ x 5 thread	21¾″	205
10″	No. 1½	10¼″	No. 10	3″ x 5 thread	21¾″	205
10″	No. 2	10¼″	No. 10	3″ x 5 thread	21¾″	205
10″	No. 2½	10¼″	No. 10	3″ x 5 thread	21¾″	205
12″	No. 3	12½″	No 11	3¼″ x 4 thrd	22½″	285
15″	No. 4	15″	No. 12	3¾″ x 4 thrd	26½″	410



Gear Cutting Head,

FOR CUTTING SPUR GEARS ONLY, AND PROVIDED WITH DIRECT AND WORM INDEXING.

Code word, 12-in. QUALM. 16-in. QUARREL.



FOR CUTTING SPIRAL AND SPUR GEARS, AND PROVIDED WITH DIRECT, WORM AND DIFFERENTIAL INDEXING.

"LeBlond" Gear Cutting Head.

HEAVY DESIGN.

When ordering give number and size of machine as stamped on face of table.

This Head has been designed to cut spiral and spur gears in large quantities. The head is much stronger and more rigid than a Universal Head, owing to the fact that it does not swivel—it is one solid casting. The worm wheel is large, is made 6.684 inches in diameter, ½ circular pitch, and designed throughout to withstand the most severe service. Spindle bearing is tapering and can be adjusted for wear. The bore and spindle nose are made the same as the machine on which it is used.

The head is furnished with direct and worm indexing, all low number divisions are made with the notched plate on the end of the spindle and can be handled very rapidly. The head is furnished with a spindle plate with 48 notches. The spindle is arranged so that three plates can be carried. Index pin is adjustable and can be set to engage any plate. Two worm index plates are furnished, these are drilled and admit of the same divisions being made as on the Universal Dividing Head, described on page 73.

Change gears are furnished for cutting complete range of spirals from 1.55 to 137.14 lead. A set of index tables is furnished in connection with this head for spacing and cutting spirals. Special index plate and differential indexing, as described on page 78, can be furnished if desired.

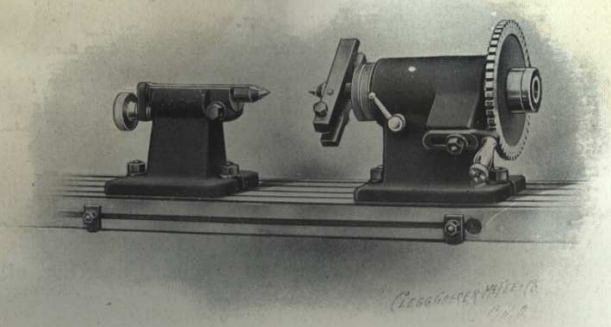
This Head in connection with Spiral Gear Cutting Attachments, described on pages 88–9, can be used on all Plain Milling Machines, for cutting spiral gears. Such gears can be cut with this combination to much better advantage than on a Universal machine. The miller must be equipped with special quick return bracket and stud to receive change gears.

This Head is furnished with the Worm and Spur Gear Hobbing Attachment, described on page 92, to be used on all Plain Milling Machines for hobbing worm gears without previous notching, and on the Universal machine both worm and spur gears can be cut with this attachment by the hobbing process.

This Head is made in two sizes, 12 and 16-inch swing.

SPECIFICATIONS.

Machine where used.	Swing.	Taper in Spindle. B. & S.	Diameter Spindle Nose.	Length Head and Foot Stock combined.	WEIGHT, 12-in.	
					With Quadrant.	Without Quadrant and Change Gear.
No. 1 & 1½	12 or 16″	No. 10	3″x 5 Thd	23	205	145
No. 2 & 2½	12 or 16″	No. 10	3″x 5 Thd	23	205	145
No. 3	12 or 16″	No. 11	3¼x 5 Thd	23	205	145
No. 4	12 or 16″	No. 12	3¾x 4 Thd	23½	220	145



"LeBlond" Index Centers for Direct Indexing.

Code word, 12-in. QUAKE. 16-in. QUALITY.

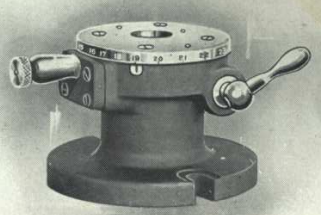
When ordering give size and number of machine as stamped on face of table.

These Index Centers are adapted for work which requires rapid indexing, such as milling squares, hexagons, etc., on nuts; cutting teeth in sprocket gears, and work of similar nature. The spindle bearing is tapering and can be adjusted for wear. Taper in spindle, and nose, is made the same as the machine on which it is to be used. The divisions are made with a single notched plate, and can be handled very rapidly. The head is furnished with one plate with 48 divisions. Spindle is arranged so three plates can be carried. The index pin is adjustable and can be set to engage any plate. The plates are a plain lathe job and can be easily duplicated and cut with any number of divisions required.

The Centers are made in two sizes, 12 and 16 inch swing.

SPECIFICATIONS.

Machine where used.	Swing.	Taper in Spindle. B.& S.	Diameter Spindle Nose.	Combined Length of Head and Tail Stock.	Diam. of Index Plate.	Tongue and T-slot Bolts for Slot.	Weight.	
							12 in.	16 in.
No. 0	12 or 16″	No. 9	2⅛″x 5T	21¾″	8″	½	85	95
No. 1	12 or 16″	No. 10	3″x 5T	21¾″	8″	⅝	85	95
No. 1½	12 or 16″	No. 10	3″x 5T	21¾″	8″	⅝	85	95
No. 2	12 or 16″	No. 10	3″x 5T	21¾″	8″	⅝	85	95
No. 2½	12 or 16″	No. 10	3″x 5T	21¾″	8″	⅝	85	95
No. 3	12 or 16″	No. 11	3¼″x 5T	21¾″	8″	⅝	85	95



"LeBlond" Vertical Index Head,

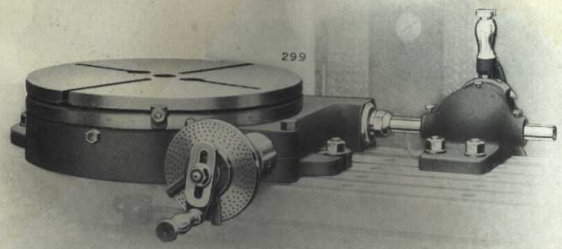
FOR DIRECT INDEXING.

Code word, QUIET.

When ordering give number and size of machine as stamped on face of table.

This Head is found to be very rapid and economical for cutting clutches, milling the heads of screws and work of that kind. The divisions are made by a single notched plate and the indexing can be done very rapidly. After the division is made, the small lever shown at the side, locks the spindle securely in position. The spindle is tapering, the front flange is extended to cover the index plate, which is entirely enclosed and protected from chips, etc. The whole attachment is very rigid and will stand up to the most severe work. Spindle has No. 11 B. & S. taper hole.

The height over all is 5¾ inches; the diameter of index plate 5 inches with 24 divisions. The Index rings are a plain lathe job, and can be cut to any number of divisions. Size of hole in spindle, No. 11 B. & S. taper. Weight, 35 lbs.



"LeBlond" Circular Milling Attachment.

Code word, QUILT.

When ordering give size and number of machine as stamped on face of table.

This Attachment is used for all kinds of circular milling, such as milling circles, segments, circular T-slots, etc., and milling irregular pieces, which have both straight and circular surfaces. It can be used to advantage with the Vertical Spindle Milling Attachment. The worm and worm wheel are accurately cut. The table has four T-slots for holding the work, and the center is bored for No. 11 B. & S. taper.

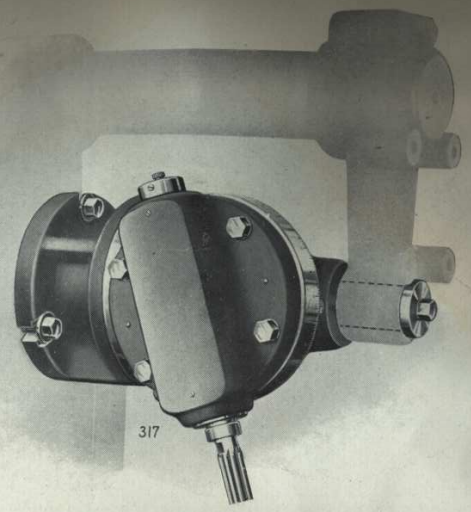
The table is graduated and can be locked in any position for straight milling. The worm is held in an eccentric bushing and can be disengaged from the worm wheel and the table revolved by hand. This also forms a convenient method of adjustment.

AUTOMATIC FEED is furnished when ordered, driven by a chain through an independent knuckle shaft from the feed box of the machine. This does not interfere with the table feeds. Pieces of irregular shape, of both straight and circular outline, can be milled with the Automatic Feed. This can be operated in either direction, and has trip dogs to automatically trip the feed to a line at any point.

SPACING. The hand wheel can be removed and index plates and sector furnished for dividing. Accurate dividing can be done, and same number of divisions obtained as on the standard dividing head. This attachment fills all requirements of a vertical dividing head, and large gears, index plates, etc. can be cut by milling on the face and using the vertical feed of the machine. An Index Table for spacing is furnished in connection with this attachment.

The height over all is 4⅞ inches; diameter of table, 17 inches; bored for No. 12 B. & S. taper hole, has ⅝-inch T-slots.

Weight, with automatic feed, 355 lbs.; weight plain, 300 lbs.



"LeBlond" Universal Milling Attachment.

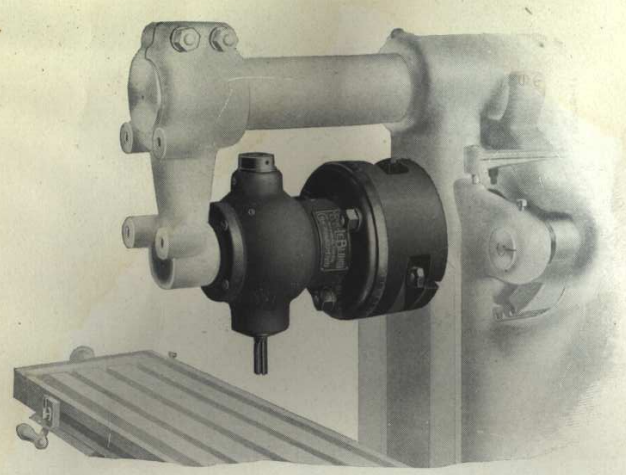
Code word, QUOITS.

When ordering give size and number of machine as stamped on face of table.

This Attachment possesses all the advantages of the light design Vertical Attachment, described on page 86, and in addition its full universal movements make it applicable to a very large range of work where the spindle is required to be set at various angles. The attachment is furnished with a base to fit the machine on which it is to be used. The swivel can be set and clamped in any position through an arc of 360 degrees, both in a horizontal and vertical plane.

The spindle is driven from the clutch on spindle nose through a pair of miter gears. The bearings are bronze and have means of adjustment to compensate for wear. Is bored for LeBlond S. B. Screw Taper; No. 4 Collet, having LeB. S.B. taper outside, LeB. S.A. taper inside, is sent with attachment. This attachment can be furnished bored for No. 9 B. & S. if so ordered.

Size of Machine where used.	Distance face of Column to center of Spindle.	Greatest distance Spindle Nose to Table.		Spindle Speeds per minute	Wgt.
		PLAIN	UNIVERSAL		
No. 1	8½	13½	12½	55–310	190
No. 1½	8½	13½	12½	12–361	190
No. 2	8½	13½	12½	12–361	190
No. 2½	8½	13½	12½	17–392	190
No. 3	10⅜	14½	13½	12½–362	210
No. 4	11 7/16	14½	14½	10–350	225



"LeBlond" Vertical Spindle Milling Attachment,

LIGHT DESIGN. Code word, QUADRAT.

When ordering give size and number of machine as stamped on face of table.

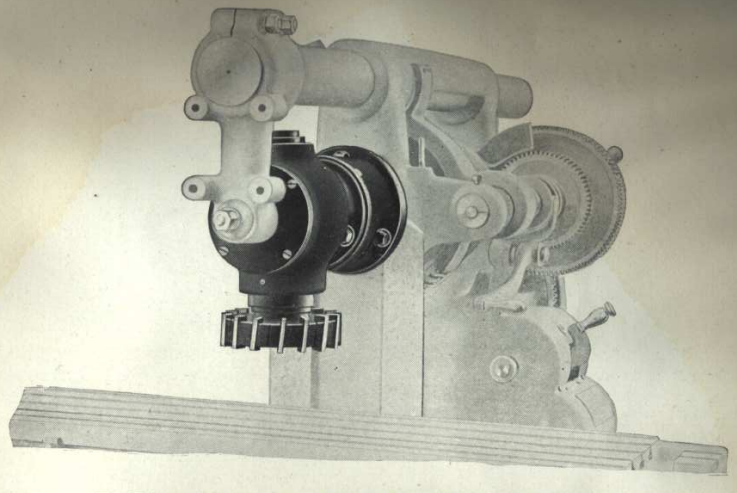
This Attachment is adapted for all kinds of light and medium milling, such as T-slotting, key-seating, die-sinking, or any kind of work in which it is advantageous to have the cutter revolve in a vertical plane.

The Attachment is furnished with a base to fit the machine on which it is to be used. It is bolted to the face of the column and the outer end is supported in the arbor support of the machine. The housing is graduated, and the spindle can be set at any angle through 360 degrees.

The spindle is driven from the clutch on the spindle nose, through a pair of miter gears. The bearings are of bronze and have means of adjustment to compensate for wear. Front end is bored for LeBlond S.B. screw taper. No. 4 Collet, LeBlond S.B. taper outside, LeBlond S.A. taper inside, is sent with attachment. This Attachment can be furnished bored for No. 9 B. & S. taper if ordered.

SPECIFICATIONS.

Size Machine where used.	Distance from Face of Column to center of Spindle.	Greatest Distance from Spindle Nose to Table.		Spindle Speeds per minute.	Weight
		PLAIN	UNIVERSAL		
No. 0	6½″	11½″		62–362	70
1	8⅜″	14½″	13½″	55–310	80
1½	8⅜″	14½″	13½″	12–361	80
2	8⅜″	14½″	13½″	12–361	85
2½	8⅜″	14½″	13½″	17–392	85
3	9 1/16″	15½″	14½″	12½–362	95
4	11 9/16″	15½″	15½″	10–350	115



"LeBlond" Vertical Spindle Milling Attachment.

HEAVY DESIGN. Code word, QUADRILLE.

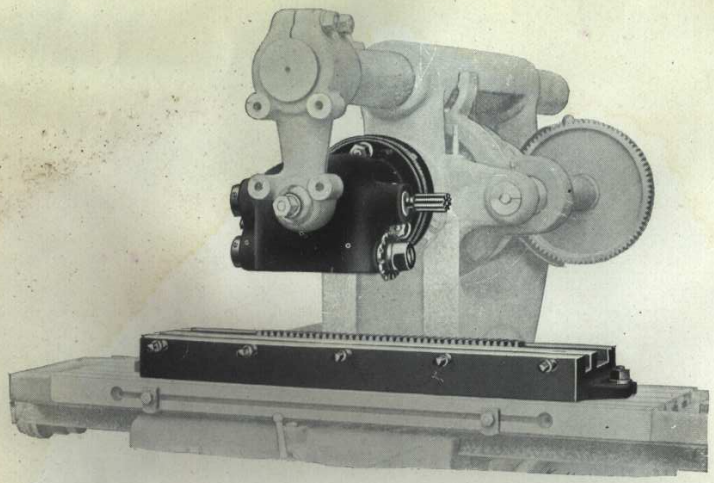
When ordering give size and number of machine as stamped on face of table.

This Attachment is adapted for the heaviest vertical milling. It will drive the full capacity of the machine and take cutters up to 12 inches in diameter. The spindle is furnished with nose and is bored the same as the spindle of the machine.

The Attachment is furnished with a base to fit the machine on which it is to be used. It is bolted to the face of the column and the outer end is supported in the arbor support of the machine and can be connected with the knee brace. The housing is graduated and the spindle can be set at any angle through 360 degrees. The spindle is driven from the clutch on the spindle nose through planed bevel gears. The front spindle bearing is tapering, hardened and ground. Bearings have means of adjustment to compensate for wear. The spindle has a hole its entire length, to receive a draw-in bolt for holding arbors, collets, etc.

SPECIFICATIONS.

Machine where used.	Taper in Spindle B.& S.	Size of Spindle Nose.	Dist. face of Column to center of Spindle.	Greatest distance from Spindle Nose to top of Table.		Spindle speeds.	Wgt.
				PLAIN	UNIV'SL		
No. 1	No. 10	3″x5 thrd	8⅝	11¼	10¼	55–310	145
No. 1½	No. 10	3″x5 "	8⅝	11¼	10¼	12–361	145
No. 2	No. 10	3″x5 "	8⅝	11¼	10¼	12–361	145
No. 2½	No. 10	3″x5 "	8⅝	11¼	10¼	17–392	145
No. 3	No. 11	3¼x5 "	10½	12	11	12½–362	160
No. 4	No. 12	3¾x4 "	12⅝	11¼	11¼	6–215	210
No. 5	No. 12	3¾x4 "	13½	12¼	....	5¼–225	240



"LeBlond" Rack Cutting Attachment.

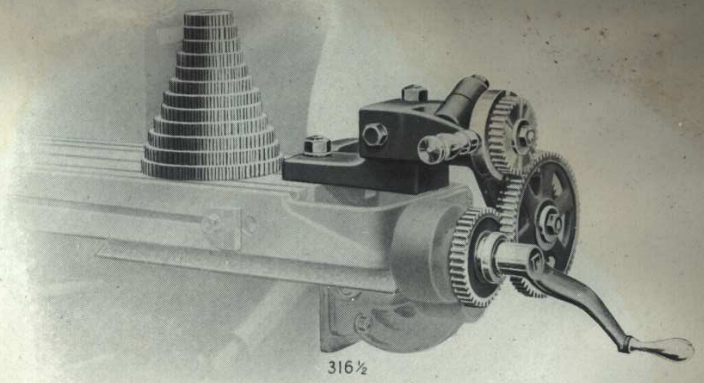
LIGHT DESIGN, Code word, QUAGGY.
HEAVY DESIGN, Code word, QUAIL.

When ordering give size and number of machine as stamped on face of table.

This Attachment is made in two sizes, "light design," and "heavy design;" is exceedingly compact and rigid in construction. The attachment is furnished with a base to fit the machine on which it is to be used. It is bolted to the face of the column and the outer end is supported in the arbor support of the machine. The cutter spindle, which is hardened and ground, is driven from the clutch on the spindle nose of the machine through hardened bevel and spur gears. The gearing is coarse pitch and is entirely enclosed and protected from chips. The chuck for holding the work will take in any width up to the full capacity and has an adjustable steel jaw, that is adjusted with set screws.

SPECIFICATIONS.

	Size of Machine where used.	Diam. of Cutter Spindle.	Size Cutter used. B.& S.	CAPACITY. Diamet'l Pitch		Greatest distance bet. Attachment and Chuck.		Capacity of Chuck.	Wgt with Chuck
				C.I.	St.	PLAIN	UNIVRS'L		
Light	No. 1	1″	No. 3	5	6	12⅛	11⅛	4x28x⅞	265
	No. 1½	1″	No. 3	5	6	12⅛	11⅛	4x28x⅞	265
	No. 2	1″	No. 3	5	6	12⅛	11⅛	4x28x⅞	265
	No. 2½	1″	No. 3	5	6	12⅛	11⅛	4x28x⅞	265
	No. 3	1″	No. 3	5	6	13⅛	12⅛	4x28x⅞	275
Heavy	No. 2	1¼″	No. 4	3	4	11¼	10¼	6x36x⅞	315
	No. 2½	1¼″	No. 4	3	4	11¼	10¼	6x36x⅞	315
	No. 3	1¼″	No. 4	3	4	12¼	11¼	6x36x⅞	315
	No. 4	1¼″	No. 4	3	4	12¼	12¼	6x36x⅞	345
	No. 5	1¼″	No. 4	3	4	13¼	....	6x36x⅞	375



"LeBlond" Rack Spacing Attachment,

FOR USE IN CONNECTION WITH RACK CUTTING ATTACHMENT.

Code word, QUADROON.

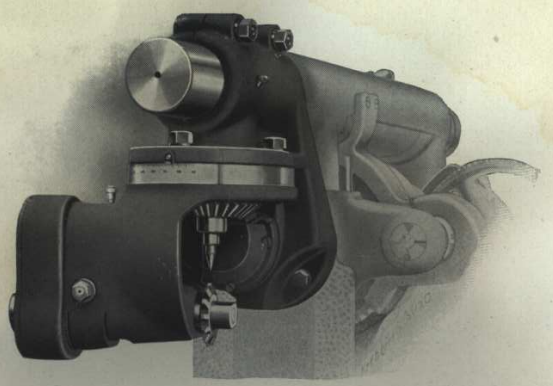
When ordering give size and number of machine as stamped on face of table.

This Attachment consists of the necessary mechanism for spacing the table when cutting rack, without the use of the graduated collar on the feed screw. It is bolted to the table and carries a quadrant and the necessary change gears to connect the feed screw with the locking disc. This locking disc is made in two sections and is reversible—one side containing two notches, the other side one, for spacing whole and half revolutions. Fifteen change gears are furnished for spacing, all diametral pitches from 3 to 6, by half pitches, 6 to 16 by whole pitches and 16 to 32 by two pitches; circular pitches from one-sixteenth to one-half by thirty-seconds, and one-half to one by sixteenths.

An Index Table is furnished for use in connection with the Attachment.

The No. 1 Attachment is for use on Nos. 1, 1½, 2, 2½ and 3, and No. 4 Attachment on No. 4, Milling Machines.

Weight of No. 1, 55 lbs.; No. 4, 65 lbs.



"LeBlond" Spiral Cutting Attachment.

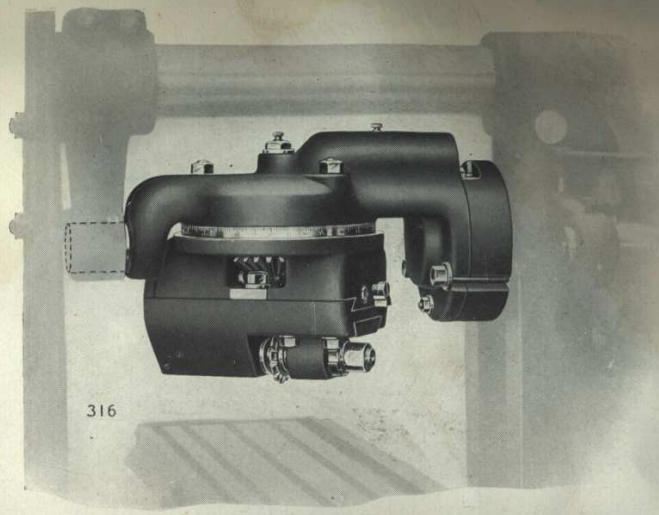
HEAVY DESIGN. Code word, QUARTET.

When ordering give size and number of machine as stamped on face of table.

This Attachment can be used either on the Plain or Universal Machine, for cutting spirals with coarse teeth. It is especially adapted for cutting gas engine spiral gears in large quantities. It is a very powerfully driven attachment and the only one made in which the arbor or driving gear is larger than the cutter. While this restricts the movement and the variety of work it greatly increases the life and power of the drive, making it a superb manufacturing proposition.

The head, carrying the cutter arbor, swivels through an arc of 150 degs., which enables gears to be cut with a spiral angle of 75 degs. with the axis of the work, right or left hand.

The Attachment is furnished with a base to fit the machine on which it is to be used. It is bolted to the face of the column and is supported by the over-arm of the machine. The cutter spindle is driven from the clutch on the spindle nose, through coarse pitch bevel and spur gears, it is hardened and ground and runs in bronze bearings which have means of adjustment to compensate for wear. Lateral adjustment for setting the cutter central, in line with axis of the swivel head and center of the work, is provided. The head can be swiveled to any angle without resetting the work or cutter. A gauge is furnished for setting the cutter. Cutter arbor is 1 inch diameter, for No. 3 B. & S. gear cutters. Greatest distance from face of column to center of cutter, Nos. 1 to 2½, 7½ in.; No. 3, 8½ in.; No. 4, 10 in. Weight, Nos. 1 to 2½, 180 lbs.; No. 3, 210 lbs.; No. 4. 225 lbs.



"LeBlond" Universal Spiral Cutting Attachment.

Code word, QUASSIA.

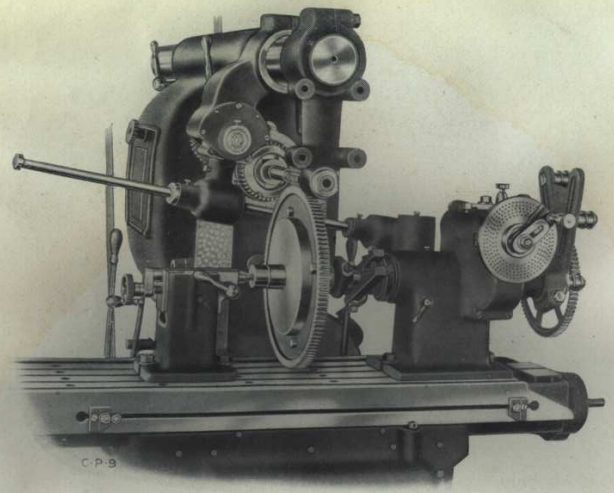
When ordering give size and number of machine as stamped on face of table.

This Attachment has all the features of the one described on the preceding page, and in addition is made entirely universal, so that spiral gears of any angle, spur gears, racks, worms, etc., can be cut. The cutter arbor can be swiveled through an arc of 360 deg. The driving gear is wide face and of such diameter that the attachment clears the work in any position. The drive to the cutter arbor is through a series of bevel and spur gears. The cutter arbor is supported at the outer end by a removable bearing carried in a slide which can be adjusted laterally.

In setting the cutter the slide is adjusted until the center line on the cutter coincides with the swivel axis of the attachment. This is done by first setting the point of the footstock center to coincide with the line on the attachment and then adjusting the cutter to suit. When the cutter is once set the attachment can be swiveled to any angle, and the correct relation of the center of the work and cutter be always maintained.

This Attachment, in connection with the Gear Cutting Head, described on page 81, and a Plain Milling Machine, makes a most substantial outfit for cutting spiral gears.

Cutter arbor is 1 inch diameter for No. 3 B. & S. gear cutters. Greatest distance from face of column to center of cutter for Nos. 1 to 2½, 9 in.; No. 3, 9½ in.; No. 4, 10¾ in. Weight, Nos. 1 to 2½, 220 lbs.; No. 3, 240 lbs.; No. 4, 260 lbs.



Hobbing Worm Wheel 120 T., 39 C.P., 15 inches diameter.

"LeBlond" Worm and Spur Gear Hobbing Attachment,

(PATENTED JULY 28, 1908.)

Code word, QUOSQUE.

This Attachment is something new in Milling Machine construction. The principle involved is analagous to that of the Gear Hobbing machine, which at present is being introduced quite extensively. This method has the following advantages:

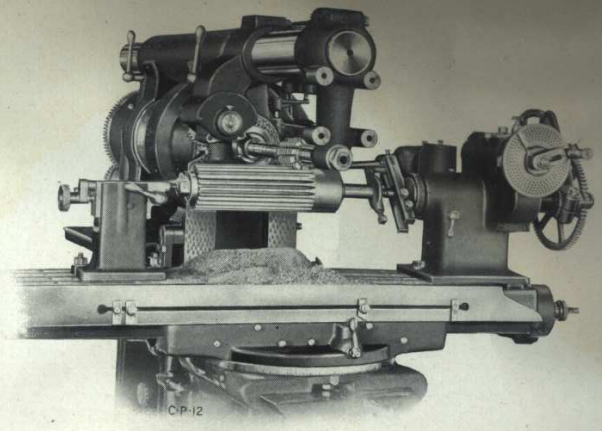
First: A single hob will cut all numbers of teeth of a given pitch.

Second: The action of the hob passing through the work generates the tooth correctly.

Third: A larger output is obtained by this method, since the hob is cutting continuously there is no time lost in returning the cutter and indexing the blank.

Fourth: In the cutting of worm wheels the Hobbing Attachment is particularly efficacious, as the preliminary operation of gashing each tooth is entirely dispensed with, resulting in gears being produced in one-fourth or one-fifth of the time, depending on the gear.

The Attachment consists of the Gear Cutting Head shown on page 80, and means for connecting the driving spindle of the milling machine with the spindle of the dividing head through flexible



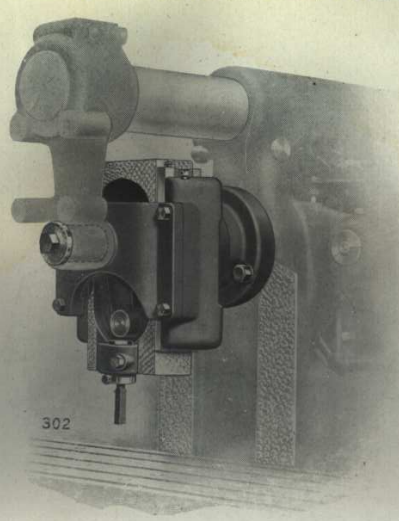
Hobbing Spur Gear, 6 P., 24 T., 14 inches face, on Universal Miller.

bevel gear joints and shaft that give positive motion to the dividing head spindle. Various ratios of speed between the two spindles for cutting various numbers of teeth are obtained by quadrant and change gears. The upper end is supported by the overarm of the machine and the attachment is driven by a gear screwed onto the spindle nose. The splined shaft on the attachment is connected at either end by two pair of mitre gears supported in swivel bearings; this combination makes a universal joint, which, unlike a knuckle joint, transmits motion evenly and positively in any position. The quadrant and change gears are carried on the end of the attachment, and are so arranged that the driving shaft can be connected either directly to spindle for cutting low numbered divisions, or through the worm and worm wheel for large numbers of teeth.

A set of compound gears is furnished for reducing the feed about twenty times to obtain the necessary fine feed to the table. Change gears are furnished for cutting all numbers from 9 to 100.

SPECIFICATIONS

Machine where used	Swing of Head	Dist. between Centers	Taper in Spindle	Will Hob Teeth	WEIGHT
Nos. 2 and 2½	16 inch	29 inch	No. 10	9–100	370 lbs.
No. 3	16 inch	35 inch	No. 11	9–100	380 lbs.
No. 4	16 inch	44 inch	No. 12	9–100	390 lbs.



"LeBlond" Slotting Attachment.

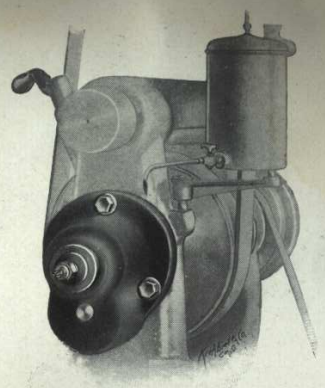
Code word, No. 2, QUOMBA. No. 3, QUOTING.

When ordering give number and size of machine as stamped on face of table.

This Attachment changes the circular motion of the miller to a reciprocal motion, as in the shaper or slotter and adapts it for all kinds of die and tool making. It will also handle many kinds of manufacturing jobs that require slotting, key-waying, or splining.

The Attachment is furnished with a base to fit the machine on which it is to be used. It is bolted to the face of the column and the outer end is supported in the arbor support of the machine. The housing is graduated and can be set at any angle throughout 360 degrees, enabling slotting to be done at any angle, from vertical to horizontal. The slotter head is driven from the clutch on the spindle nose and is adjustable to any length of stroke, from 0 to full capacity. The tool holder is graduated and can be swiveled in its bearing and clamped, enabling the cutting edge of the tool to be set in correct relation to the work without disturbing its adjustment.

Attachment Number.	Machine where used.	Stroke.	Size of Tool Shank.	Distance face of Column to center of Tool.	Weight.
No. 2	No. 1	2¾″	⅝″	8⅜″	210
	No. 1½	2¾″	⅝″	8⅜″	210
	No. 2	2¾″	⅝″	8⅜″	210
	No. 2½	2¾″	⅝″	8⅜″	210
	No. 3	2¾″	⅝″	9⅝″	225
No. 3	No. 3	3¾″	¾″	10⅛″	240
	No. 4	3¾″	¾″	13¼″	260
	No. 5	3¾″	¾″	14½″	280



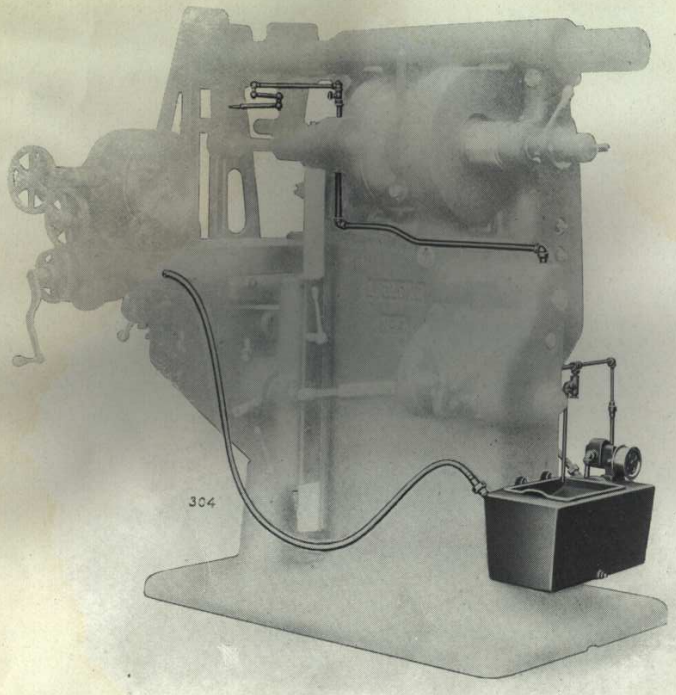
"LeBlond" High Speed Milling Attachment.

Code word, QUINCE.

When ordering give size and number of machine as stamped on face of table.

This Attachment is very simple in construction, being driven by spiral gears, which obviates noise at high speed. There are no belts required and as many speed changes can be obtained as upon the main spindle of the machine. The attachment is bolted to the face of the column and is driven by a spiral gear screwed on the nose of the spindle. The spindle is hardened and ground and runs in phosphor bronze bearing, with means of compensating for wear. Front end is bored for the LeBlond S. A. taper. The entire mechanism is enclosed and protected from dirt. Spindle is in the same plane as the main spindle, so that the capacity of the machine is not reduced in any way.

Size of Attachment.	Machine where used.	Speed Range.	Size Taper.	Distance from face Column to Spindle Nose	Weight.
No. 1	No. 1	220–1200	LEB. S.A.	7⅞″	30
	No. 1½	48–1444	LEB. S.A.	7⅞″	30
	No. 2	48–1444	LEB. S.A.	7⅞″	30
	No. 2½	68–1568	LEB. S.A.	7⅞″	30
No. 3	No. 3	55–1590	LEB. S.B.	8″	40
No. 4	No. 4	37–1295	LEB. S.B.	9″	45



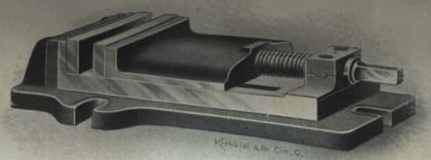
Oil Pump and Tank.

Code word, QUANK.

When ordering give size and number of machine as stamped on face of table.

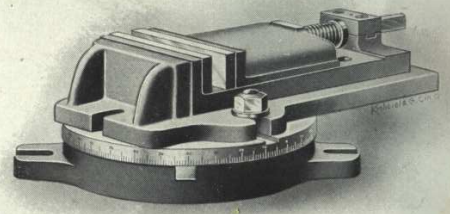
The cut above shows our No. 4 Milling Machine equipped with Pump and Tank and necessary piping for flooding the cutter with either oil or soda water. We recommend this attachment on all milling machines where steel or wrought iron is to be milled extensively. The Pump is mounted on the tank at the rear of the machine and is driven from an independent pulley on the countershaft. The oil is returned to the tank by two flexible tubes connected at each end of the table. Table pockets are provided with strainers. This attachment can be supplied to all Plain and Universal Machines. Weight, 100 lbs.

This Attachment is not required on Heavy Duty Millers.



"LeBlond" Plain Milling Machine Vise.

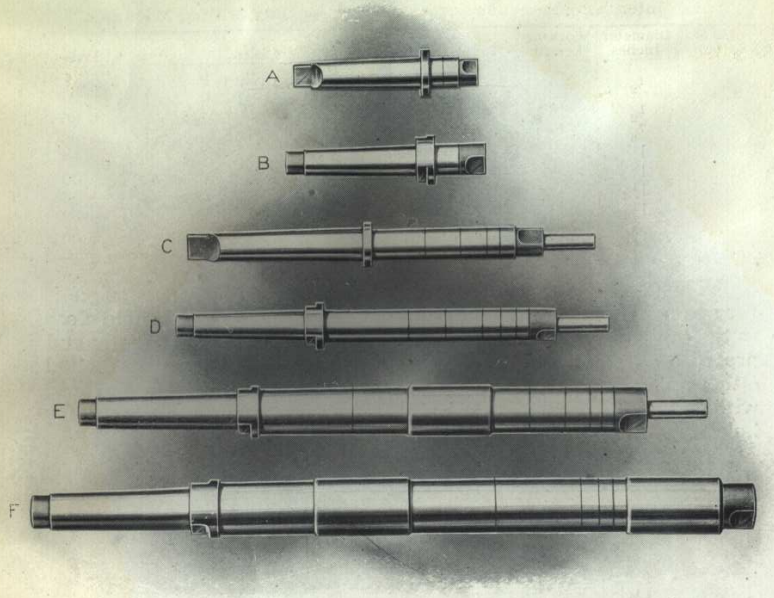
This Vise is exceptionally rigid in construction, the design is very compact and the height is such that the work can be held close to the table. This Vise has two grooves, milled at right angles and provided with loose tongues, and with the flanges, can be bolted either in line or at right angles to the table. The jaws are held with screws and are removable. Special jaws can be inserted for holding special or irregular shaped pieces.



SWIVEL BASE.

This cut shows the Vise mounted on Swivel Base. The swivel is graduated and has grooves milled in the top to fit the vise. Base can be clamped in position on the table and vise swiveled through any angle. This arrangement combines all the desirable features of both the plain and swivel vise. This Swivel Base is regularly furnished with all Universal Milling Machines, and fits the dividing head, enabling it to be swiveled throughout any angle the same as the vise.

Size.	Width of Jaw.	Depth of Jaw.	Opens.	Weight.
No. 2	5½	1⅜	3½	50
No. 3	7¼	1⅝	5	90
No. 4	8½	2½	7	150



"LeBlond" Cutter Arbors.

We carry in stock most of the Arbors listed on the next page. These are made of forged tool steel, have the ends hardened and are ground all over. Arbors with No. 10 taper, and larger, are made with a clutch, so that they can be driven from the spindle nose, and are tapped out at the rear end to fit the arbor rod of the machine. We do not furnish a nut on the arbor for spanner wrench—the arbor rod in the machine is constructed so that the arbor can be forced out, as well as held into, the taper.

Arbors are tapped as follows: No. 10 taper, ¾ x 12 threads. No. 11 taper, ⅞ x 12 threads. No. 12 taper, $1\frac{5}{16}$ x 12 threads.

Arbors 1 inch in diameter and larger are milled with keyways, as follows: 1 inch diameter, $\frac{5}{32}$ wide x $\frac{5}{64}$; 1¼ inch, $\frac{3}{16}$ x $\frac{3}{32}$; 1½ inch, ¼ x ⅛; 1¾ and 2 inch, $\frac{5}{16}$ x $\frac{5}{32}$.

Arbors with working length longer than 12 inches are furnished with hardened sleeve to fit the middle arbor support on the machine.

Cutter Arbor List.

Arbors interchange on Cone Driven and Heavy Duty Milling Machines.

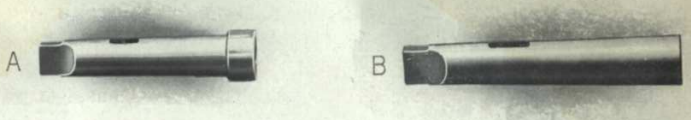
No. of Arbor	Diameter Inches.	Working Length	Taper.	Machine where used.	Style.	Price.
0	½	1	7	with B Collet on No. 0 P E Collet on 1, 1½, 2, 2½	A	$2.85
1	½	1	9	No. 0 Plain	A	3.60
2	⅞	1	10	No. 1, 1½, 2, 2½ P and U	B	4.00
3	1	1	10	No. 1, 1½, 2, 2½ P and U	B	4.00
4	1	1	11	No. 3 P and U	B	4.50
5	1¼	1½	11	No. 3 P and U	B	4.50
6	1¼	1½	12	No. 4 P and U. No. 5 P	B	5.00
8	⅝	4	9		C	4.00
9	⅞	6	9		C	4.50
10	⅞	8	9	No. 0 Plain	C	5.00
11	1	6	9		C	4.50
12	1	8	9		C	5.00
15	⅞	6	10		D	5.00
16	1	6	10		D	5.00
17	1¼	6	10		D	5.50
18	⅞	8	10		D	6.00
19	1	8	10		D	6.00
20	1¼	8	10		D	6.50
21	⅞	10	10	Nos.	D	7.00
22	1	10	10	1, 1½, 2, 2½	D	7.00
23	1¼	10	10	Plain	D	7.50
24	⅞	12	10	and	D	8.00
25	1	12	10	Universal	D	8.00
26	1¼	12	10		D	8.50
27	⅞	14	10		E	9.00
28	1	14	10		E	9.00
29	1¼	14	10		E	9.50
35	⅞	10	11		D	7.50
36	1	10	11		D	7.50
37	1¼	10	11		D	8.00
38	⅞	14	11		E	9.50
39	1	14	11		E	9.50
40	1¼	14	11	No. 3	E	10.00
41	1	18	11	Plain	E	12.00
42	1¼	18	11	and	E	12.50
43	1½	18	11	Universal	E	13.00
44	1¼	22	11		E	14.00
45	1½	22	11		E	15.00
46	1¼	26	11		E	16.00
47	1½	26	11		E	17.00
50	1¼	16	12		F	12.00
51	1½	16	12		F	13.00
52	1¼	20	12		F	14.00
53	1½	20	12		F	15.00
53A	1¾	20	12		F	16.00
54	1¼	24	12		F	16.00
55	1½	24	12	No. 4	F	17.00
55A	1¾	24	12	Plain and Universal	F	19.00
55B	*2	28	12	and	F	20.00
56	1½	28	12	No. 5 Plain	F	20.00
56A	1¾	28	12		F	20.00
56B	*2	28	12		F	20.00
57	1½	32	12		F	20.00
58	1¾	32	12		F	21.00
59	*2	32	12		F	21.00
60	1¾	36	12	*Arbors marked with a * for No. 5 Plain only	F	22.00
61	*2	36	12		F	22.00

Cutter Arbors for "LeBlond" Milling Machines.

The Arbors listed below are sent with the machines, and have been selected as well suited for the machine with which they are furnished. On Universal Milling Machines Arbor marked thus *, is included with machine. On Plain Milling Machines Arbors are not included, but are sent subject to approval of purchaser at price quoted in list.

SIZE OF MACHINE.	ARBOR NO.	DIAM. INCHES.	WORKING LENGTH	TAPER	STYLE
No. 0 Plain	11	1	6	9	C
No. 1 Plain	15	7/8	6	10	D
	19	1	8	10	D
No. 1½, 2 and 2½ Plain	18	7/8	8	10	D
	22	1	10	10	E
No. 3 Plain	36	1	10	11	E
	40	1¼	14	11	E
No. 4 Plain	50	1¼	16	12	F
	53	1½	20	12	F
No. 1 Universal	15	7/8	6	10	D
	*19	1	8	10	D
No. 1½, 2 & 2½ Univs'l	18	7/8	8	10	D
	*22	1	10	10	E
No. 3 Universal	36	1	10	11	E
	*40	1¼	14	11	E
No. 4 Universal	50	1¼	16	12	F
	*53	1½	20	12	F
No. 3 Plain Heavy Duty	40	1¼	14	11	E
	45	1½	22	11	E
No. 4 Plain Heavy Duty	50	1¼	16	12	F
	55A	1¾	24	12	F
No. 5 Plain Heavy Duty	53	1½	20	12	F
	59	2	32	12	F
No. 3 Univ. Heavy Duty	*40	1¼	14	11	E
	45	1½	22	11	E
No. 4 Univ. Heavy Duty	*50	1¼	16	12	F
	55A	1¾	24	12	F

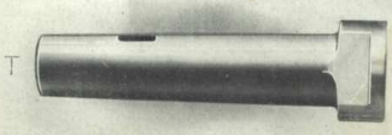
*Arbors are included with machine.

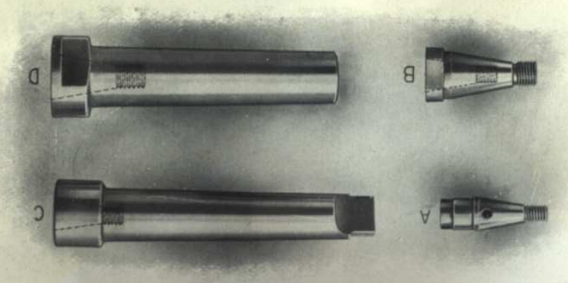


B. & S. Taper Collets.

No. of Collet.	Outside Taper.	Inside Taper.	Machine where used.	Style.	Price net to User.
A	7	4	E Collet	B	$2.00
B	9	7	No. 0 Plain, F, G and T Collet	A	3.25
C	9	5	No. 0 Plain, F, G and T Collet	B	3.00
E	10	7	Nos. 1, 1½, 2 and 2½ P and U	T	4.75
F	10	9	Nos. 1, 1½, 2 and 2½ P and U	T	5.25
G	11	9	No. 3 Plain and Universal	T	6.00
T	12	9	No. 4 P and U and No. 5 P	T	6.50

Collets interchange on Cone Driven and Heavy Duty Millers.



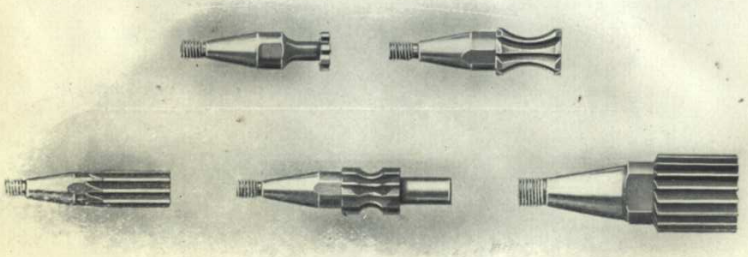


"LeBlond" Screw Taper Collets.

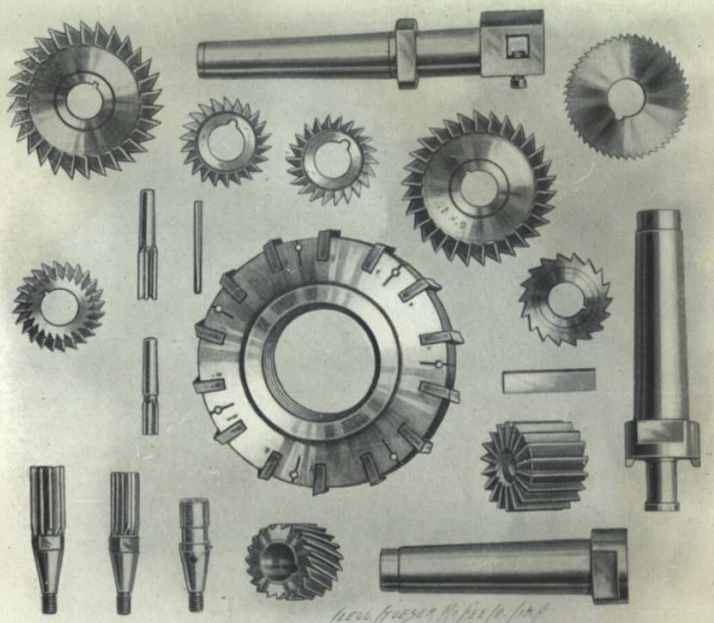
This style taper has three decided advantages over the ordinary style, viz.:—(1) It is impossible for the taper to work loose, which makes it invaluable for T-slot milling; (2) It can be easily removed or changed, as it is taken out with a wrench; (3) When changing cutters the collets do not have to be removed from spindle.

No. of Collet.	Outside Taper	Inside Taper.	Where used.	Style.	Price net to User.
1	LeB. S A	B.& S. 4	Nos. 4, 5, 6, 7 and 9 Collets	A	$1.75
2	LeB. S A	5	Nos. 4, 5, 6, 7 and 9 Collets	A	2.00
3	LeB. S B	7	Nos. 8 and 10 Collets	A	3.00
4	LeB. S B	LeB. S A	Nos. 8 and 10 Collets	B	3.00
5	B.& S. 9	S A	No. 0 Plain Milling Mach ne	C	3.00
6	" 10	S A	No. 1, 1½, 2, 2½ P. and Un	D	3.00
7	" 11	S A	No. 3 Plain and Univ	D	3.25
8	" 11	S B	No. 3 Plain and Univ	D	3.75
9	" 12	S A	No. 4 P.& U. and No. 5 P.	D	4.25
10	" 12	S B	No. 4 P.& U. and No. 5 P.	D	4.25

Collets interchange on Cone Driven and Heavy Duty Millers.



The cut shows Mills made with LeBlond Screw Taper shanks. The taper is made very steep and is held in by the thread at the end. The cutters have a square milled in the diameter to fit a wrench for removing them from collet.



Tools for "LeBlond" Milling Machines.

The following lists of Tools we have found by experience to be among those first needed. Cut shows tools sent with No. 3 Universal and is representative of various lists following: these are shipped with machine—if not wanted to be carefully repacked and returned by express, at our expense.

Tools for No. 0 Plain Milling Machine.

Collet No. 5, No. 9 B. & S. Taper outside, LeBlond S.A. inside
Collet No. 1 LeBlond S.A. Taper outside, No. 4 B. & S. inside
Collet Drift
End Mill, $\frac{5}{16}$-inch, No. 4 B. & S. Taper
End Mill, $\frac{3}{8}$-inch, No. 4 B. & S. Taper
End Mill, $\frac{3}{4}$-inch, LeBlond S.A. Taper
End Mill, $1\frac{1}{8}$-inch, LeBlond S.A. Taper
Milling Cutter, $2\frac{1}{4}$x$\frac{1}{2}$x1-inch hole
Milling Cutter, $2\frac{1}{4}$x1x1-inch hole
Milling Cutter, $2\frac{1}{4}$x$1\frac{3}{4}$x1-inch hole
Two Side Milling Cutters, $2\frac{3}{4}$x$\frac{1}{2}$x1-inch hole
Metal Slitting Saw, $2\frac{1}{2}$x$\frac{1}{8}$x1-inch hole
T-slot Cutter, $\frac{1}{2}$-inch Standard LeBlond S.A. Taper

Price net, to user **$20.00**

Tools for Nos. 1, 1½, 2 and 2½ Plain Milling Machines.

Collet No. 6, No. 10 B. & S. Taper outside, LeBlond S.A. Taper inside
Collet No. 2 LeBlond S. A. Taper outside, No. 5 B. & S. Taper inside
Collet Drift
End Mill, ⅜-inch, No. 5 B. & S. Taper
End Mill, ½-inch, No. 5 B. & S. Taper
End Mill, ⅝-inch, No. 5 B. & S. Taper
End Mill, 1⅛-inch, LeBlond S. A. Taper
Shell End Mill, 2⅞x2¼x1-inch hole
Shell End Arbor, 1-inch, No. 10 B. & S. Taper
Milling Cutter, 2½x2x1-inch hole
Milling Cutter, 2½x1x1-inch hole
Milling Cutter, 2½x⅜x1-inch hole
Metal Slitting Saw, 3x1/16x1-inch hole
Two Side Milling Cutters, 4x⅝x1-inch hole
Angular Cutter, 60 deg. R.H. 2¾x1-inch hole

Price net, to user..... **$34.00**

Tools for No. 3 Plain Milling Machine.

Collet No. 7, No. 11 B.& S. Taper outside, LeBlond S.A. Taper inside
Collet No. 2, LeBlond S.A. Taper outside, No. 5 B. & S. Tap r inside
Collet Drift
End Mill, ½-inch, No. 5 B. & S. Taper
End Mill, ⅝-inch, No. 5 B. & S. Taper
End Mill, ¾-inch, LeBlond S.A. Taper
End Mill, 1⅛-inch, LeBlond S.A. Taper
Shell End Mill, 2⅞x2¼x1-inch hole
Shell End Arbor, 1-inch, No. 11 B. & S. Taper
Milling Cutter, 2½x2x1¼-inch hole
Milling Cutter, 2½x1x1¼-inch hole
Milling Cutter, 2½x⅜x1¼-inch hole
Metal Slitting Saw, 4x⅛x1¼-inch hole
Two Side Milling Cutters, 5x¾x1¼-inch hole
Angular Cutter, 60 deg. R.H. 3x1¼-inch hole
Angular Cutter, 60 deg. L.H. 3x1¼-inch hole
Inserted Tooth Face Milling Cutter, 6½x2-in., tapped to fit spindle nose

Price net, to user..... **$50.00**

Tools for Nos. 4 and 5 Plain Milling Machine.

Collet No. 9, No. 12 B.& S. Taper outside, LeBlond S.A. Taper inside
Collet No. 2, LeBlond S.A. Taper outside, No. 5 B. & S. Taper inside
Collet Drift
End Mill, ½-inch, No. 5 B. & S. Taper
End Mill, ⅝-inch, No. 5 B. & S. Taper
End Mill, 1-inch, LeBlond S.A. Taper
End Mill, 1¼-inch, LeBlond S.A. Taper
Shell End Mill, 2⅞x2¼x1-inch hole
Shell End Arbor, 1-inch, No. 12 B. & S. Taper
Milling Cutter, 4x½x1½-inch hole
Milling Cutter, 4x2x1½-inch hole
Mi'ling Cutter, 4x3x1½-inch hole
Milling Cutter, 4x6x1½-inch hole
Metal Slitting Saw, 6x1/16x1½-inch hole
Two Side Milling Cutters, 6x1/8x1½-inch hole
Inserted Tooth Face Milling Cutter, 8½x2, tapped to fit spindle nose

Price net, to user..... **$77.00**

Tools for Nos. 1, 1½, 2 and 2½ Universal Milling Machines.

Collet No. 6, No. 10 B.& S. Taper outside, LeBlond S.A. Taper inside
Collet No. 2, LeBlond S.A. Taper outside, No. 5 B. & S. Taper inside
Collet Drift
End Mill, ⅜-inch, No. 5 B. & S. Taper
End Mill, ½-inch, No. 5 B. & S. Taper
End Mill, ⅝-inch, No. 5 B. & S. Taper
End Mill, 1⅛-inch, LeBlond S.A. Taper
Shell End Mill, 2⅞x2¼x1-inch hole
Shell End Arbor, 1-inch, No. 10 B. & S. Taper
Milling Cutter, 2½x2x1-inch hole
Milling Cutter, 2½x⅜x1-inch hole
Two Side Milling Cutters, 4x⅝x1-inch hole
Angular Cutter, 60 deg. R.H. 2¾x1-inch hole
Spiral Milling Cutter, 48 and 12 deg. 2¾x1-inch hole
Fly Cutter Arbor, No. 10 B. & S. Taper, ⅝x⅝x3-inch Tool

Price net, to user..... **$38.00**

Tools for No. 3 Universal Milling Machine.

Collet No. 7, No. 11 B.& S. Taper outside, LeBlond S.A. Taper inside
Collet No. 2, LeBlond S.A. Taper outside, No. 5 B. & S. Taper inside
Collet Drift
End Mill, ½-inch, No. 5 B. & S. Taper
End Mill, ⅝-inch, No. 5 B. & S. Taper
End Mill, ¾-inch, LeBlond S.A. Taper
End Mill, 1⅛-inch, LeBlond S.A. Taper
Shell End Mill, 2⅞x2¼x1-inch hole
Shell End Arbor, 1-inch, No. 11 B. & S. Taper
Milling Cutter, 2½x2x1¼-inch hole
Milling Cutter, 2½x⅜x1¼-inch hole
Metal Slitting Saw, 4x⅛x1¼-inch hole
Two Side Milling Cutters, 5x¾x1¼-inch hole
Angular Cutter, 60 deg. R.H. 3x1¼-inch hole
Angular Cutter, 60 deg. L.H. 3x1¼-inch hole
Spiral Milling Cutter, 48 and 12 deg. 3x1¼-inch hole
Inserted Tooth Face Milling Cutter, 6½x2-in. tapped to fit spindle nose
Fly Cutter Arbor, No. 11 B. & S. Taper and ⅝x⅝x3-inch Tool

Price net, to user..... **$57.00**

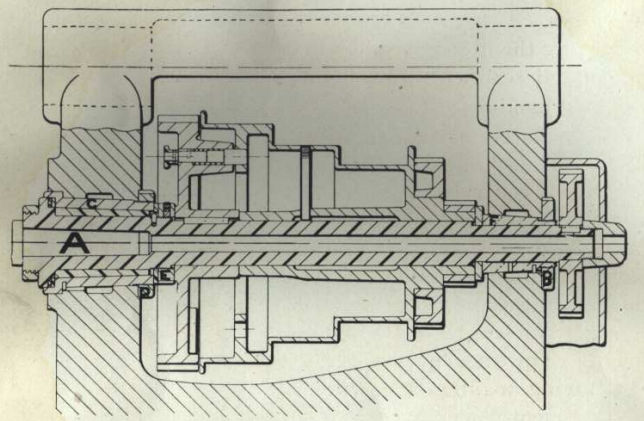
Tools for No. 4 Universal Milling Machine.

Collet No. 9, No. 12 B.& S. Taper outside, LeBlond S.A. Taper inside
Collet No. 2, LeBlond S.A. Taper outside, No. 5 B. & S. Taper inside
Collet Drift
End Mill, ½-inch, No. 5 B. & S. Taper
End Mill, ⅝-inch, No. 5 B. & S. Taper
End Mill, ¾-inch, LeBlond S.A. Taper
End Mill, 1⅛-inch, LeBlond S.A. Taper
Shell End Mill, 2⅞x2¼x1-inch hole
Shell End Arbor, 1-inch, No. 12 B. & S. Taper
Milling Cutter, 2½x2x1¼-inch hole
Milling Cutter, 2½x⅜x1¼-inch hole
Metal Slitting Saw, 4x⅛x1¼-inch hole
Two Side Milling Cutters, 5x¾x1¼-inch hole
Angular Cutter 60 deg. R.H. 3x1¼-inch hole
Angular Cutter, 60 deg. L.H. 3x1¼-inch hole
Spiral Milling Cutter, 48 and 12 deg. 3x1¼-inch hole
Inserted Tooth Face Milling Cutter, 8½x2-in. tapped to fit spindle nose
Fly Cutter Arbor, No. 12 B. & S. Taper, and ⅝x⅝x3-inch tool

Price net, to user..... **$62.00**

Adjustment and Care of Millers.

Our Milling Machines are properly adjusted and carefully inspected before leaving the shop and should not require readjustment for a year. All parts are made so as to compensate for wear. To produce good work and a quantity of it it is imperative that the machine be kept in proper adjustment.



The front journal of spindle is made tapering, the back journal straight. The thrust is taken at front end of spindle by a hardened steel and babbit collar. The wear on these collars will be in proportion to the wear on the spindle, and when adjusted back to fit the box will come to a proper bearing on the end thrust.

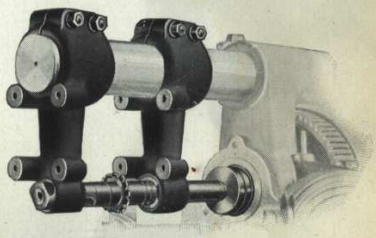
To Adjust the Front Journal, draw the spindle back into box by tightening nut E. This nut is directly on the spindle and draws the spindle back into the box. There should be a space between the nut and face gear.

To Adjust the Rear Journal, tighten the nut B, this draws the taper bronze bush back into the column, compressing it on the spindle. The adjustment of spindle will not interfere with the alignment of the machine.

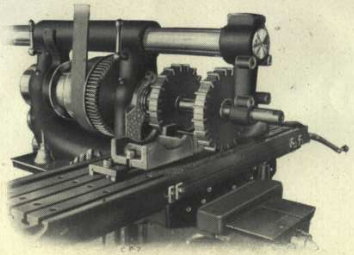
To Adjust the end motion of Table and Cross Feed Screws. These screws run in a bush screwed into the table and saddle; by removing the graduated collar on the screws a nut is exposed to view, tightening this nut will take up the end motion of the screw between its bearings. Care should be taken that the nut is securely

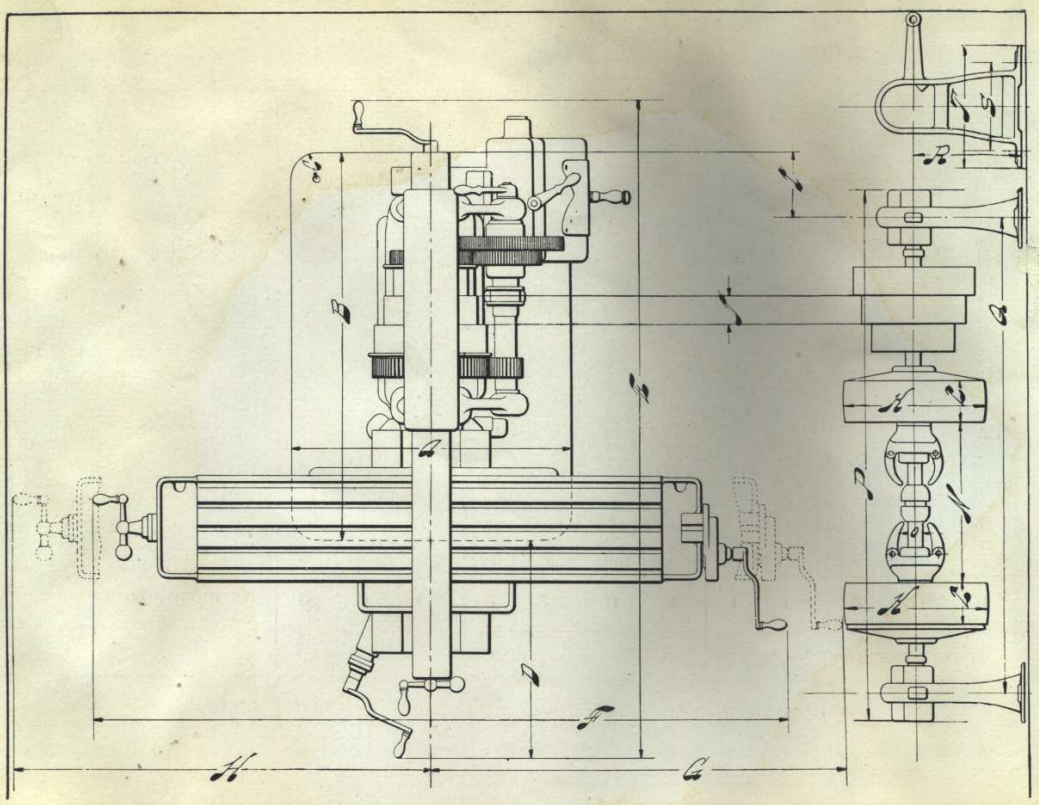
fastened after adjustment. The table gib is made tapering and is supplied with a tongue at the lower edge to keep it from lifting, it is adjusted longitudinally by screws which securely lock it for end movement. With this style of gib we secure a metal to metal bearing. The gib being securely fastened cannot raise or move when the table is at the extreme position. By this method we secure freer table movement, avoiding cramp occasioned by movement of the gib. To adjust the knee and saddle gibs tighten the large fillister head screws.

Locking the different movements of the machine does not interfere in any way with the gib adjustment and is accomplished by the locking handles. In accurate work see that all movements not in use are securely locked, this greatly stiffens the machine. Place the cutter as close to the body of the machine as possible. Use the braces and supports on the overhanging arm for heavy work. Two supports are furnished. If cutters are used at the extreme end of a long arbor see that both supports are used. The knee brace can be reversed, giving maximum amount of cross movement when brace is used. It can be bolted to either of the arbor supports.



To Remove the Spindle from the Machine, take off the nut carrying the arbor extracting rod, unscrew nut E and this will force the spindle out. Care should be taken of the last two or three threads by tapping the end of the spindle with a piece of babbit or soft metal so that the nut can be removed without forcing. When this nut is clear the spindle can be withdrawn from the machine. The nut must be raised to clear the spindle key.





Reference Table "LeBlond" Cone-Driven Milling Machines.

NO. OF MACHINE—	PLAIN							UNIVERSAL					
	0	1	1½	2	2½	3	4	1	1½	2	2½	3	4
	INCH	INCH	INCH	INCH	INCH	INCH	INCH	INCH	INCH	INCH	INCH	INCH	INCH
A Width of Base	23	25	25	27	27	32	37	25	25	27	27	32	37
B Length of Base	30½	33½	33½	36	36	43	54	33½	33½	36	36	43	54
C Distance to Bolt Holes	2	2½	2½	2½	2½	4	4	2½	2½	2½	2½	4	4
D Front Overhang	18	21	21	21	21	21½	27½	21	21	21	21	21½	27½
E Length over all	57	53½	63½	64¾	69¾	71	88¼	63½	63½	64¾	64¾	71	88¼
F Table over all	45½	63½	63½	70¾	70¾	80	96½	59½	59½	66	66	75	91
G Greatest distance from center	36	46¼	46¼	51¼	51¼	58	79¾	43¼	43¼	49	49	53½	65
H " " "	32½	42	42	46¾	46¾	56½	67½	39¼	39¼	45	45	52	62½
COUNTERSHAFT													
I End of Column to cent. of Hanger	1 9/16	5/8	2 3/16	3⅛	4 5/16	5¾	7⅜	5/8	2 3/16	4⅛	4 5/16	5¾	7⅜
J Width of Cone Belt	2½	3	3	3	3	3½	4½	3	3	3	3	3½	4½
K Diameter of Counter Pulleys	10	10	10	10	14	16	18	10	10	10	14	16	18
	14	14	14	14	14	16	18	14	14	14	14	16	18
L Width of Belt	3	3½	3½	3½	4	4½	5	3½	3½	3½	4	4½	5
N Distance between Pulleys	14	14	14	14	17	20	22	14	14	14	17	20	22
Q Diameter of Countershaft	1 9/16	1 9/16	1 9/16	1 9/16	1 9/16	1 13/16	2 3/16	1 9/16	1 9/16	1 9/16	1 9/16	1 13/16	2 3/16
P Length over all	49	52½	49	49	52½	60	71½	52½	49	49	52½	60	71½
Q Distance between cent. of Hangers	43	47	43	43	47	54	65	47	43	43	47	54	65
R Drop of Hangers	10½	10½	10½	10½	10½	12	13½	10½	10½	10½	10½	12	13½
S Distance between holes	9⅛	9⅛	9⅛	9⅛	9⅛	10¾	12⅞	9⅛	9⅛	9⅛	9⅛	10¾	12⅞
T Length of Hanger over all	12⅜	12⅜	12⅜	12⅜	12⅜	14½	17½	12⅜	12⅜	12⅜	12⅜	14½	17½
M Revs. Counter Pulley per minute	90	90	110	110	205	180	185	90	110	110	205	180	185
	250	240	265	265	245	220	230	240	265	265	245	220	230

Instructions for Setting up.

ERECT MILLER ON A GOOD FLOOR—It is essential that the floor should be free from vibration and stiff enough so that it will not give under the weight of the miller. Where possible stone or concrete foundation will answer the purpose much better. When leveling use only solid packing under the base. Level in both directions, using an accurate level. See that the column rests securely on all corners.

Place the Countershaft directly over the Miller. This is necessary in order to have the belt clear the over-arm. Have the countershaft in line with the line shaft. When the hangers are securely tightened countershaft should revolve freely. Place the thrust collars so that the shaft has one-eighth inch end play. The pulleys also should have one-sixteenth inch end play on the bush—this end play helps distribute the oil. Place pulley for slow speeds next to driving cone. Both pulleys should run in the same direction, this will double the spindle speeds, also give a quick change without shifting the belt.

Countershaft Pulleys can be Oiled without throwing off the belt and should be oiled once a week. The journal boxes are self-oiling and the reservoir should be filled to oil hole. If the shaft has been removed care should be taken to have wicking properly replaced in the boxes and threaded around the shaft. Countershaft should be speeded according to reference table, this gives an intermediate change of speed between cone changes. Care must be taken that feed pulley runs in direction shown by arrow on feed box.

To Oil the machine observe the following rules: Use a good mineral oil. Fill the spindle oil chambers from oilers on the side of column. All oil holes are furnished with dust proof oilers. In oiling the feed box place the lock pin handle in the lowest hole, in this position the oil holes in the yoke can be readily filled from an oil can. The table, saddle and gearing in saddle are oiled through oil holes at the front of saddle. Oilers are placed in all parts of the machine, showing very clearly where oil is required. The machine and countershaft should be thoroughly cleaned and oiled and let run thirty minutes under careful inspection to see that all parts run properly.

Characteristics LeBlond Universal Cutter and Tool Grinder.

Design—Analagous to Universal Milling Machine

A new construction for a Cutter Grinder which

Embodies

Rigidity,

A factor in Accurate Grinding

- Due to absence of
  - Posts
  - Split Bearings
  - Stems
- Characteristic of
  - Knee
  - Saddle
  - Table
  - Swivel

  Of Milling Machine Type
- Admits of almost Unlimited Capacity
  - 8x17 between Centers
  - Milling Cutters, 18 inches diameter
  - Saws, etc. 36 in. diameter

Convenience

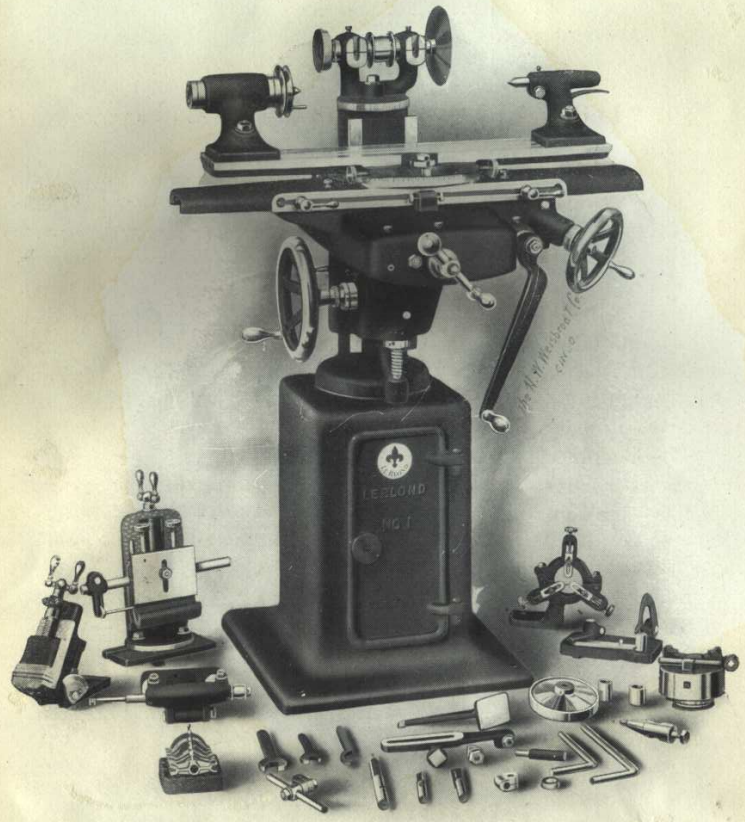
Conducive to Large Production

- Levers attached to each end of all movements
  - All Adjustments operative from any position
  - Admits of close observation of work at all times
  - Levers adjustable and can be quickly set to operator's fancy
- Graduated Swivel with Fine Screw Adjustment throughout 180 deg.
  - Diameter one-half length of Table
  - Graduated 180 deg.
    - Accurate reading of Graduations
    - Table can be set by graduations 90 deg. either side of center
    - Angle Cutters ground correctly without use of protractor
    - Rigid support to Table at any angle
  - By Thumb Screws acting against Adjustable Stop
    - Operative throughout swivel movement to Table
    - Efficacious for setting Table absolutely to any taper
    - Can be quickly disengaged for swiveling table
- Fine Feed to Table and Lever Motion
  - Through worm and special gear for Cylindrical and Internal Grinding.
  - Can be instantly disengaged with Eccentric Sleeve
  - Direct connected by large gear engaging Rack
  - Gives **Quick** and **Sensitive Traverse** to Table
  - Lever operates in vertical plane and can be set to any position

Simplicity,

A salient feature of a machine exposed to Emery Dust

- Of whole Construction
  - Condenses number of detail parts in Knee
  - Fewer parts subjected to wear and exposure to emery dust
  - Permits the use of Taper Gibs to take up wear
  - Great vertical adjustment eliminates use of Drop Centers
  - Gives ample space for surface grinding
- Method of Holding Work
  - Cutters held and ground on their own arbors
  - Insures Cutters running true
  - No special Collets, Bushes, etc. required
  - All Cutters ground without use of special attachments
- Method of Supporting Work
  - Only two Tooth Rests required
  - Cover every class of work machine will grind
  - Support from Wheel Head, Table or Universal Attachment



Universal Cutter and Tool Grinder.

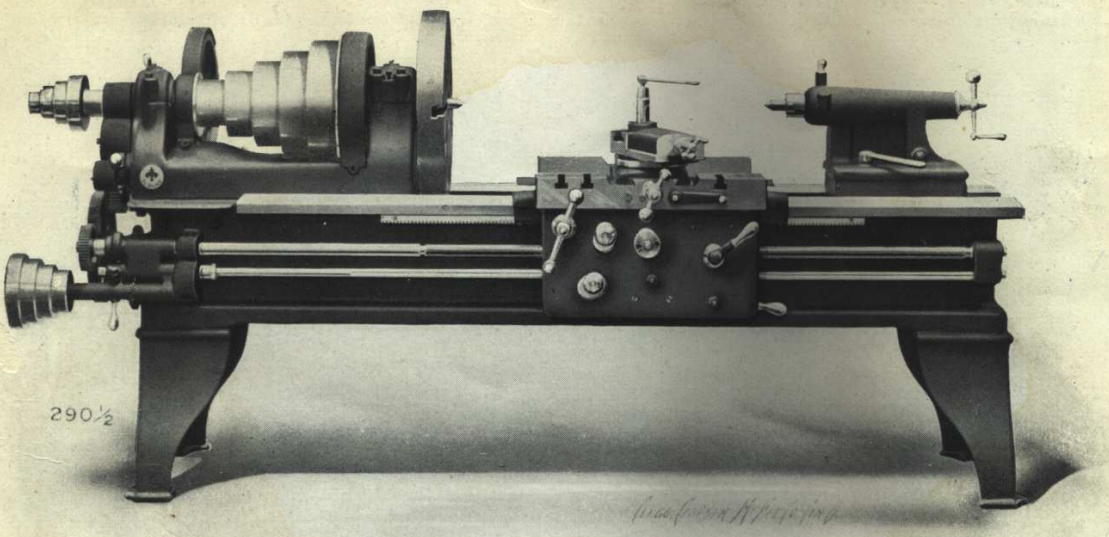
The "LeBlond" Universal Cutter and Tool Grinder.

The cut on opposite page shows the LeBlond Universal Cutter and Tool Grinder. Recognizing the importance of sharp cutters as an absolute necessity for rapid and economical milling, we have brought out this Grinder. The principle of the machine is entirely new and is an embodiment of the design as used on the LeBlond Universal Milling Machines, consisting of a knee, saddle, swivel carriage and table. This gives a rigidity to the machine that has heretofore been lacking in a cutter grinder and makes the machine well adapted to take in the large inserted tooth mills so frequently met with in modern milling practice.

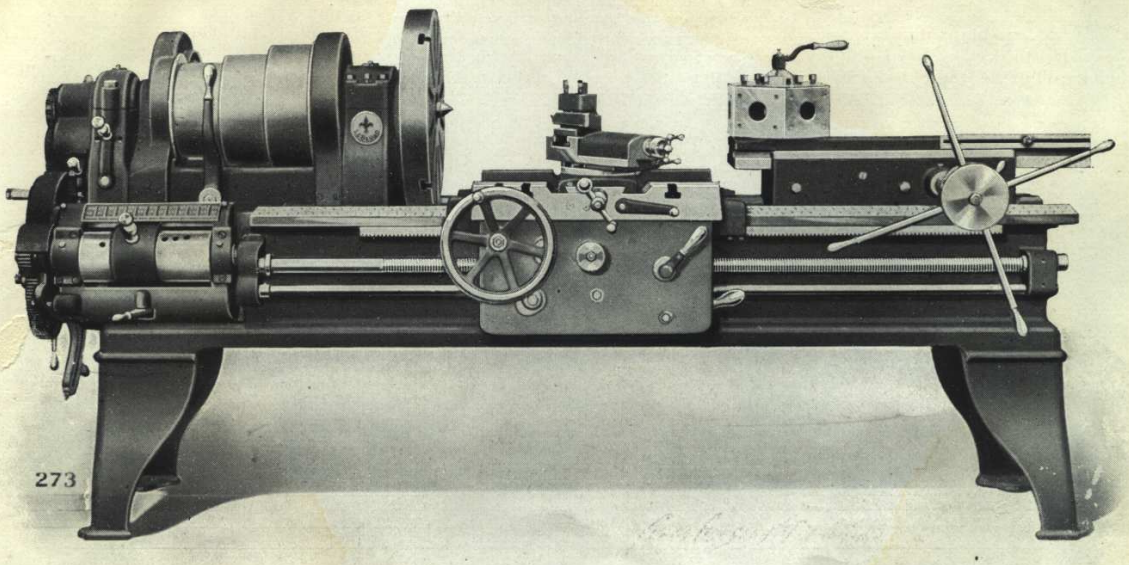
The machine is absolutely universal and will grind any angle, taper or face. It is adapted for grinding all kinds of cylindrical, internal, face and angular work, face mills, end mills, reamers, counterbores, circular saws, snap gauges, gear cutters, rose reamers, flat surfaces, and all other tool room work.

A complete line of attachments for this machine is made as follows: Universal Attachment, Circular Grinding Attachment, Internal Grinding Attachment, Gear Cutter Grinding Attachment, Surface Grinding Attachment, etc.

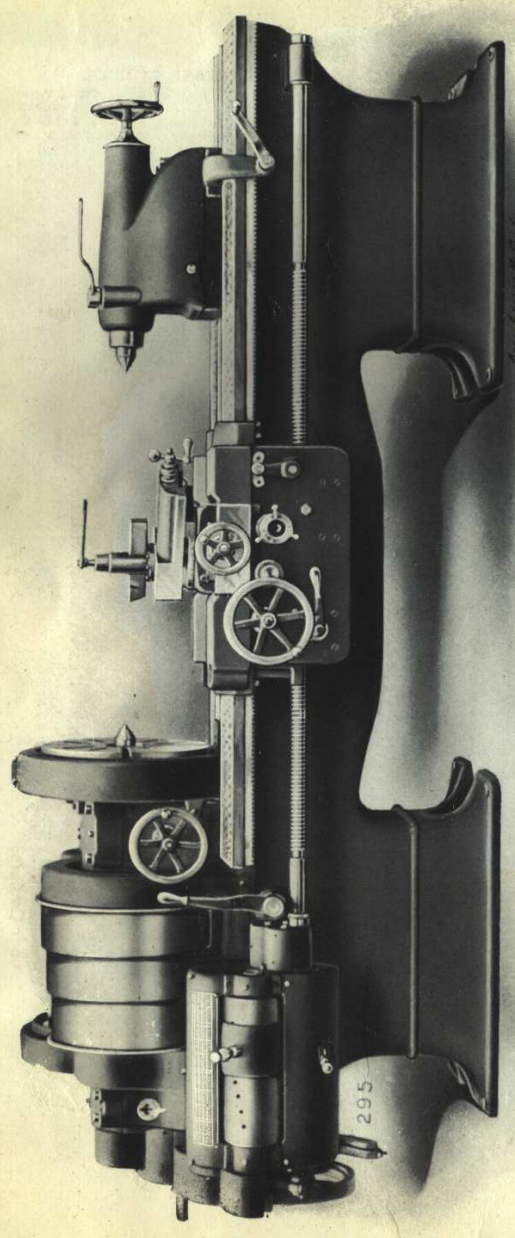
Catalog, giving full description of its construction and use, will be mailed upon application.



This cut of an 18-inch Lathe is representative of our regular line of Engine Lathes. They are built with both Standard and Quick Change feed and screw cutting; have independent rod- and screw-feed, and ample driving power for all regular manufacturing requirements. They are made in any style of head, rest, or combination of turret, and for an all-around moderate priced lathe cannot be excelled.



This cut represents our 20-in. Double Friction Back-Geared Head, with Power Feed, Turret on Shear. We manufacture a great many different combinations of Turrets with Engine Lathes, and can give you a machine that will suit any kind of work, and produce this work in the least possible time. In a great many cases we can put lathe work on a manufacturing basis, with our Combination Lathes, which cannot be handled on any Standard line of Turret Lathes made.



The above cut represents our Heavy Duty Engine Lathes. These Lathes are designed throughout on a basis of the power required to take a given cut, and are not an adaptation of an old lathe with a few parts added. They are made in sizes, 18 to 30-inch swing and will take care of heavy, continuous duty to the full swing of the lathe, the basis of the design being the strength of the cutting tool, which is the weakest link in the chain. They are manufactured in both the Single Pulley Drive or Double Friction Back Geared style. All feed gears are of steel. The bed is so designed that the thrust of the cut on the full swing never extends over the ways. They have a number of special features which are explained in our HEAVY DUTY BOOKLET.

TELEGRAPHIC CODE.

Plain Millers.

	CODE WORD
No. 0	Pand
1	Park
1½	Pamp
1½ All Power Feeds	Pawn
2	Paint
2 All Power Feeds	Pang
2½	Packet
2½ All Power Feeds	Paper
3	Parl
3 All Power Feeds	Palm
4	Paddle
4 All Power Feeds	Papyrus

If **Motor Drive** is wanted add word **Direct**

Universal Millers.

	CODE WORD
No. 1	Peace
1½	Pebble
1½ All Power Feeds	Peck
2	Pedal
2 All Power Feeds	Pedestal
2½	Pedang
2½ All Power Feeds	Pegram
3	Peeper
3 All Power Feeds	Peerless
4	Penton
4 All Power Feeds	Pequot

If **Tools** are wanted add **"ols"** to code word

Heavy Duty Millers.

No. 3 Plain	Obelisk
No. 4 Plain	Occident
No. 5 Plain	Officer
No. 3 Universal	Onward
No. 4 Universal	Opaque

Extra Equipment.

Chuck, 6-inch	Quota
Chuck, 9-inch	Quiz
Circular Milling Attachment, p 84	Quilt
with Power Feed	Quorum
for Spacing	Quoth
Cutter and Tool Grinder—	
Universal, complete, page 112	Golden
Plain	Grinder
Differential Indexing Device p 78	Quifferen
Gear Cutting Head, 12-in., page 80	Qualm
with Change Gear and Quadrant	Qualify
Gear Cutting Head, 16-in	Quarrel
with Change Gear and Quadrant	Quell
High Speed Milling Attach't, p 95	Quince
Index Center, 12-inch page 82	Quake
Index Center, 16-in	Quality
Oil Pump and Tank, page 96	Quank
Rack Cutting Attach. light, page 88	Quaggy
Rack Cutting Attachment, heavy	Quail
Rack Spacing Attachment, p 89	Quadroon
Slotting Attachment, No. 2, page 94	Quomba
Slotting Attachment, No. 3	Quoting
Spiral Cutting Attach. heavy, p 90	Quartet
Special Dividing Head, page 79,	
10-inch	Quidity
12-inch	Quicksan
15-inch	Quietus
Universal Dividing Head, 10-in. p72	Quart
with Quadrant and Change Gear	Query
Universal Dividing Head, 12-in	Quash
with Quadrant and Change Gear	Quick
Universal Dividing Head, 15-in	Quattle
with Quadrant and Change Gear	Quintet
Universal Milling Attachment, p 85	Quoits
Universal Spiral Cutting Att., p. 91	Quassia
Vertical Spindle Milling Attachm't	
Light, page 86	Quadrat
Heavy, page 87	Quadrille
Vertical Index Head, page 83	Quiet
Vise, plain, No. 2, page 97	Quintal
with Swivel Base	Quite
Vise, plain, No. 3	Quire
with Swivel Base	Quiver
Vise, plain, No. 4	Quaint
with Swivel Base	Quilly
Worm and Spur Gear Hobbing, p 92	Quosque

Arbors.

0	Piano	18	Pious	37	Plateau	53	Plunge
1	Pica	19	Pippin	38	Platoon	53A	Plunket
2	Pick	20	Pique	39	P ayer	54	Plural
3	Picture	21	Pirate	40	Plead	55	Plush
4	Pierce	22	Pistol	41	Please	55A	Pliers
5	Pigeon	23	Pitch	42	Pledge	55B	Plebian
6	Pike	24	Pity	43	Plenty	56	Pluto
8	Pilfer	25	Pivot	44	Pleura	56A	Plenary
9	Pilgrim	26	Place	45	Pliant	56B	Plebisite
10	Pillar	27	Placid	46	Plodder	57	Pluvial
11	Pilot	28	Plague	47	Plough	58	Pneumonia
12	Pimple	29	Plaid	50	Pluck	59	Poise
15	Pinch	35	Plaster	51	Plumb	60	Pongee
16	Pinery	36	Plate	52	Plunder	61	Pontiff
17	Pink						

Screw Collets.

1	Poach	4	Poetry	6	Polar	8	Polka
2	Pocket	5	Point	7	Police	9	Pollen
3	Poem					10	Pollute

Price.

Wire immediately price, and how soon you can ship ..... Knead
What is net cost to us ?..... Knell
What is regular net selling price of Knife
Has there been change in price of .. Knight
What will be the extra expense of .. Knit
Extra expense will be..... Knob
Have you made any quotations to... Knock
Have only quoted regular prices..... Knoll
Regular price is best we can do..... Knout
These prices are net cash to you..... Knur
These are net selling prices..... Kobalt
These prices are subject to your regular discount..... Kopeck
Prices are subject to a discount of Koran
These prices are f.o.b..... Kral
These prices are f.o.b. Cincinnati... Kraken
These prices are f. o.b. New York... Kufic
These prices are boxed f.o.b. Steamer, New York ..... Kumiss
Price includes double friction countershaft and everything shown in cut, bxd. f.o.b. Stmr. New York Kursall
Are unable to modify our quotation Kurstod
Will allow you special concession of Kurzon
Price named is satisfactory, will mail you formal order to-day ... Kusioska
Prices quoted are not satisfactory... Kusrot
See price list for desired informat'n Kustan
Cannot accept at the price..... Kutsag
Make quotations deliver'd f.o.b. cars Kyanize
Terms net 30 days..... Label
Terms net 60 days..... Labial
Terms net 90 days..... Lace
Terms 30 days net, less 2% discount cash 10 days from date invoice.. Lache
Terms cash on presentation of bill lading to your N. Y. banker..... Lack
Terms 60 days sight draft attached to bill lading..... Lacker

Order.

Enter our order for ..... Lackey
Enter our order for —— provided delivery is guaranteed in ..... Laconic
Add to our order..... Lacuna
Have you shipped our order of (to) Ladder
Order depends on prompt delivery Lade
Can positively secure order if you can deliver in ..... Ladino
Hold order number —— for further instructions..... Ladrone
Send what you can our order at once balance follow soon as possible Laic
Cancel our order for——, substitute Laird
Hold subject to our order ..... Laity
Have secured order for..... Lake
Wire whether can fill order or not.. Lakin
Cannot accept your order ..... Lama
We advise you to order immediately Lamb
Can not guarantee delivery unless order is placed at once..... Lame
If ordered immediately could ship in Lambent
Will be able to execute your order in Lanima
Your order was shipped on..... Lamp
Have not received formal order..... Lanate
Your order received and will have our prompt attention..... Lance
If wanted you must order at once... Land
Should you order please arrange for payment with some N.Y.banker or enclose sight draft with order Lane

Ship.

How soon can you ship ?..... Laniard
Have you shipped ?..... Laniary
When did you ship ? ..... Lank
When will you ship ? ..... Lantern
May we ship by——?..... Lapse
Why don't you ship ?..... Lapwing
How much will it delay shipment to change from——to——?..... Larch
If it will not delay shipment change from——to——..... Lard
How long will shipment be delayed Lares
If shipment is delayed ..... Lariat
Can you ship in carload with..... Larmier
Will you ship in carload with..... Larrup,
If you have not shipped hold for further instructions..... Larum
Ship via ..... Larva
Ship as soon as possible..... Lascar
Ship to the care of ..... Lash
Ship by North German Lloyd ..... Lasso
Ship by No. Germ. Lloyd to Naples Lataka
Ship by No. Germ. Lloyd to Genoa Latent
Ship by Champagnie Generale Transatlantique..... Latish
Ship via Wilson Line ..... Latria
Ship by Anchor Line ..... Latrine
Ship by Furness Line..... Latted
Ship by Cunard Line ..... Latice,
Ship by American Line..... Laud
Ship by Express ..... Laugh
Ship by Freight..... Launch
By what line have you shipped ?.... Laurel
Get ready for immediate shipment Lavish
To be shipped not later than..... Lawn
Can ship immediately.. ..... Lazar
Can ship in ..... Lazuli
Ship as per your instructions..... Leach
We are ready to ship..... Leaded
Will ship not later than..... League
Shall we ship alone or hold for shipment together with ..... Leather
Shipped today all we possibly can, complete order soon as possible Lection
They will not be ready to ship until Lecher
Arranged to ship by next steamer.. Ledge
Will ship at consignees risk and expense ..... Leech
We have shipped..... Legacy
We will ship in ..... Legate
We can ship in about three days..... Leger
We can ship in about five days ..... Legion
We can ship in about one week..... Legume
We can ship in about ten days..... Legrand
We can ship in about two weeks..... Lemon
We can ship in about three weeks.. Lenner
We can ship in about thirty days... Lender
Can ship in about forty-five days ... Lent
We can ship in about sixty days..... Leper
Can ship in about seventy-five days Lesion
We can ship in about ninety days .. Lethal
Time of shipment named is the very best we can do..... Levant
Shipment is less than carload, have you anything else to fill up car Level
Shipment delayed in consequence of Leveret

Stock.

Have one in stock, but could not furnish in duplicate until..... Lintel
Have one in stock for immediate shipment..... Lira
Nothing of an approximate size in stock ..... Lisp
Have no machines in stock specified but can supply at once..... Litany
In stock for immediate shipment.... Literal
Next lot will be completed ..... Lithe
Have sold all machines in lot coming through now..... Litmus
Have you in stock for immediate shipment..... Litter
We have not the machine ordered but could ship immediately..... Livre
How many have you in stock..... Livery
What have you in stock ?..... Lizard
We have not the machine ordered but could ship immediately..... Livre
Ship from your stock ——to..... Llama
Next lot No 1 Plain Milling Machines will be completed..... Raccoon
Next lot No 1½ Plain completed..... Racket
Next lot No 2 Plain completed..... Radial
Next lot No 2½ Plain completed..... Radical
Next lot No 3 Plain completed..... Radius
Next lot No 4 Plain completed..... Raffles
Next lot No 1 Universal completed Sable
Next lot No 1½ Universal compltd Sacking
Next lot No 2 Universal completed Saddle
Next lot No 2½ Universal compltd Sadder
Next lot No 3 Universal completed Safety
Next lot No 4 Universal completed Sage

Miscellaneous.

What is the net weight ..... Lounge
What is the shipping weight ..... Louver
What is freight rate Cincinnati to .. Lovage
Kindly reply to our letter of —— in relation to——..... Loyal
See our letter of—— ..... Luber
Has letter been received ..... Lubric
Your letter has not come to hand... Lucent
Give you telegraphic refusal contingent on reply within 48 hours... Lucern
Very urgent, reply immediately by wire..... Luff
Send sample work machine to make Lune
Have sent sample of work requested Lung
Shall we attend to the insurance?... Lupine
Insure for amount of invoice ..... Lurch
Do nothing until you hear from us Lurid
Will wait for your letter before taking definite action..... Luscious
See letter mailed you tonight ..... Luster
Have placed amount to your credit with..... Lute
Send full particulars by mail at once Luteous
Mail your latest catalogue of Milling Machines ..... Proctor
Letter received will be governed accordingly ..... Luxate
Do not insure, as this has been attended to..... Luxury
Your bankers state have received no instructions to pay our bill..... Lyceum
Cannot comply with your request... Lydian
Answer as favorably as possible, so we can show customer your reply Lymph
How much will you deduct if following is not wanted..... Lynch
Weight will be about—— pounds..... Lynx
Wire plain language without cipher Macaw
Have not received letter to which you refer..... Madder
Have acted in accordance with letter Maestro
Have not written in reference to—— but will do so by next mail ..... Magenta
Send a copy of letter of ..... Maglip
Why do you not answer letter of—— please give immediate attention Mahout
Since our last letter ..... Maid
Just received enquiry from——for Maize
Would advise sending your representative there at once ..... Major
Enquiry looks very favorable..... Malkin
Have you sent check for last shipmt Mallaw
Can we draw on you at sixty day sight for last shipment, answer Manacle
We have drawn on you at sixty day sight for last shipment, please honor when presented ..... Maniciple
Our draft dated——has been protested, what is the cause. Answer Mandate
Our draft dated——for—— returned unpaid, will you mail check at once Answer..... Mandible

Amount in Dollars, Cents, or Lineal Feet.

1	Ash	15	Dog	65	Hill	600	Raw
2	Adz	16	Doll	70	Hod	700	Red
3	Bed	17	Dorf	75	Jet	800	Sad
4	Bli	18	Fast	80	Jud	900	Sob
5	Bow	19	Elf	85	Koz	1000	Son
6	Bux	20	Fald	90	Led	2000	Sty
7	Cad	25	Fay	95	Linn	3000	Sub
8	Cel	30	Fist	100	Mad	4000	Sock
9	Cob	35	Ford	150	Met	5000	Urn
10	Cro	40	Fost	200	Mug	6000	Vex
11	Cram	45	Gag	250	Myr	7000	Vill
12	Dale	50	Ghot	300	Oak	8000	West
13	Dan	55	Ham	400	Pen	9000	Wick
14	Deer	60	Hat	500	Pik	10000	Wry

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