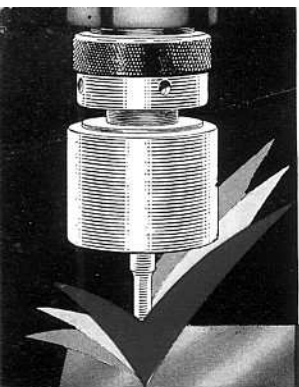


PRATT & WHITNEY

JIG BORERS



PRATT & WHITNEY JIG BORERS

THE HOLE STORY IN JIG TIME...

IT is a more important story than ever. Industry demands greater precision, a better quality of work, and lower costs. With wages and material costs high, it is essentially necessary that the tools of production — jigs, fixtures, dies, molds — be more accurate and more productive. Also, that the cost of making such tools in the toolroom be held to a minimum. Consequently, industry is demanding high-speed precision boring. The Pratt & Whitney Jig Borers produce these needed results.

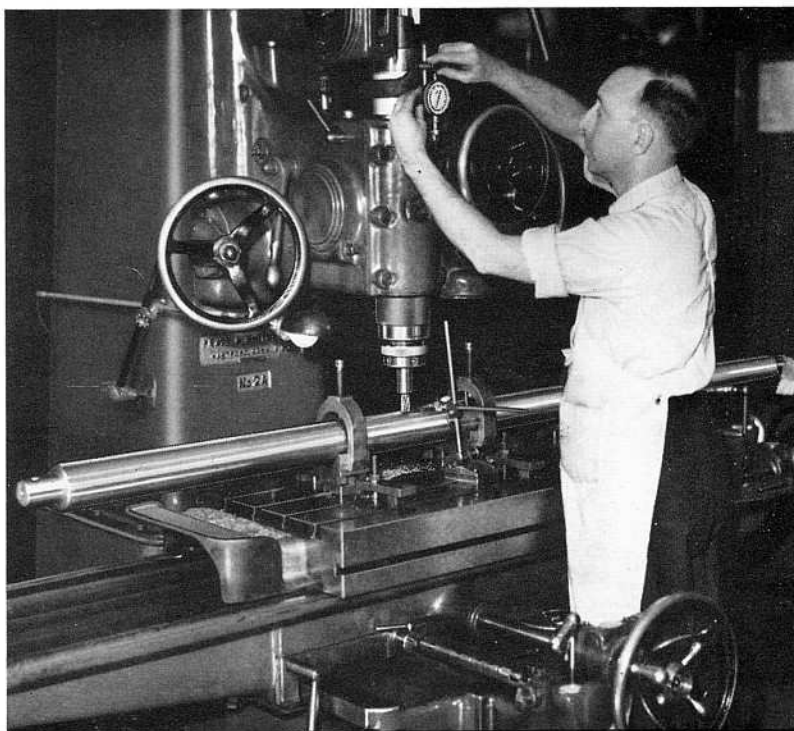
Today, successful plant and tool shop management doesn't gamble on accuracy in the making of precision tools. It makes certain that it employs accurate Jig Borers which permit the operators to produce the required precision quickly and confidently — dependable Jig Borers that maintain their initial precision indefinitely without costly maintenance and expensive down-time losses.

These high-speed Pratt & Whitney machines have carried the art of precision boring a long step forward. To the basic principles which have characterized P&W Jig Borers since they were introduced in 1917 have been added many new features which have speeded up production. These include higher spindle speeds, a wider feed range, and many built-in conveniences which make machine operation easier and quicker. These features are illustrated and explained in detail on other pages in this book.

All Pratt & Whitney Jig Borers are of open-side construction, with a vertical spindle. This is an important advantage in placing and holding work, and provides for a very large range without sacrificing accuracy. It also enables the operator to see and follow the progress of his work more closely.

(continued on page 4)

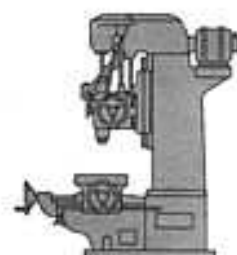
Star toolroom precision boring machine, the P&W Jig Borer also doubles as a "jig eliminator" in small-lot precision manufacturing. Here the depth dial indicator and positive stop of a No. 2A (2430) machine are being set preparatory to milling a precision slot in the first of half a dozen long steel shafts.



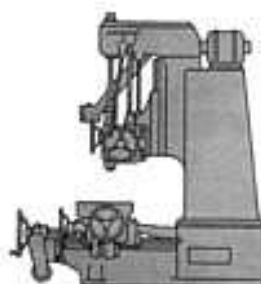
+ LOCATE
 ⊙ BORE
 ⊙✓ and CHECK



No. 1 1/2 B



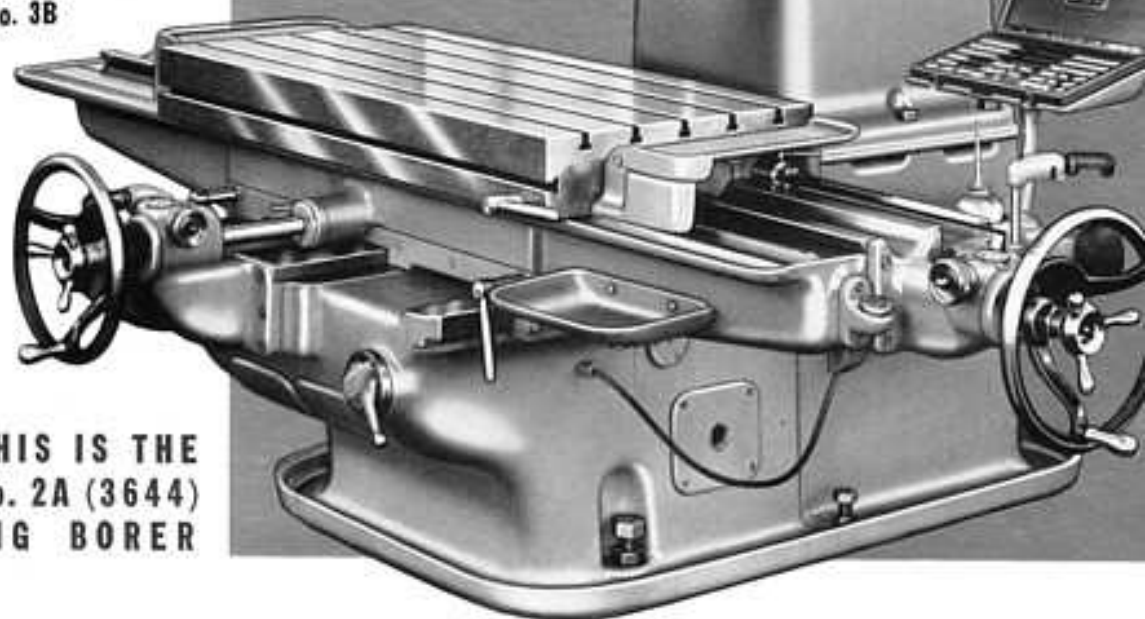
No. 2 A
(2430 and 3644)



No. 3B

In the complete line of P&W Jig Borers there is a size to meet YOUR requirements (see table below)

**THIS IS THE
No. 2A (3644)
JIG BORER**



Machine	Longitudinal Table Travel	Table Working Surface
No. 1 1/2 B	18"	12" x 24"
No. 2A (2430)	24"	16" x 30"
No. 2A (3644)	36"	22" x 44"
No. 3B*	48"	24" x 54"

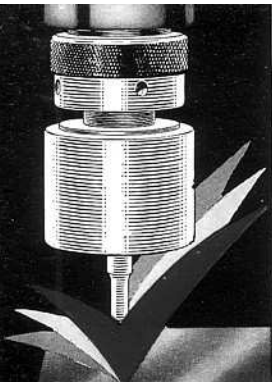
*This machine can be obtained with Built-in 42-inch or 48-inch diameter Rotary Table. See page 19.

THE various sizes and capacities of the Pratt & Whitney Jig Borer line constitute a complete "one-source" range that meets every Jig Borer need.

Detailed specifications and an illustration of each size are contained on pages 24 to 29.

(For precision spacing and boring in extremely large work, investigate the new No. 4E Jig Borer which has a longitudinal table travel of 60" and a rectangular table working surface of 36" x 72". Detailed specifications sent on request.)

LISTED ON PAGES 24 THROUGH 29.



PRATT & WHITNEY JIG BORERS

THE "JIGTIME" STORY, Continued.

The P&W Jig Borer is the finest example of the machine tool builder's art that has yet been turned out. Being designed to do precision work, it must be, and is, precision built in every detail. It is here that P&W gage making experience counts heavily, for Pratt & Whitney craftsmen are trained to gage precision. Their skill is evidenced in the way every piece in a P&W Jig Borer is precision made and fitted. Outsiders, seeing these machines being assembled, have marveled at the care and exactitude in every detail.

Pratt & Whitney have no secrets in manufacturing Jig Borers. If any, the "secret" is in our absolute insistence on precision in every step. The best way for

a prospective buyer of a Jig Borer to realize the high quality of this machine is to see it first-hand. We will be glad to show our shop and our methods without reservations. Visit us at our modern West Hartford plant and you will be deeply impressed with the real meaning of accuracy and quality. On the other hand performance and reputation are the best references for any machine tool. In hundreds of shops P&W Jig Borers are daily justifying their reputation for fast, high-accuracy boring on a wide range of work. Undoubtedly we can refer you to an interesting P&W Jig Borer installation nearby which you can inspect.

The best proof of any machine's economy and fitness is the work it can do. In this book are shown a few typical precision boring jobs, a small part of the thousands being turned out. Study these jobs and the speed at which they are finished. As with any other precision operation, the wider tolerated

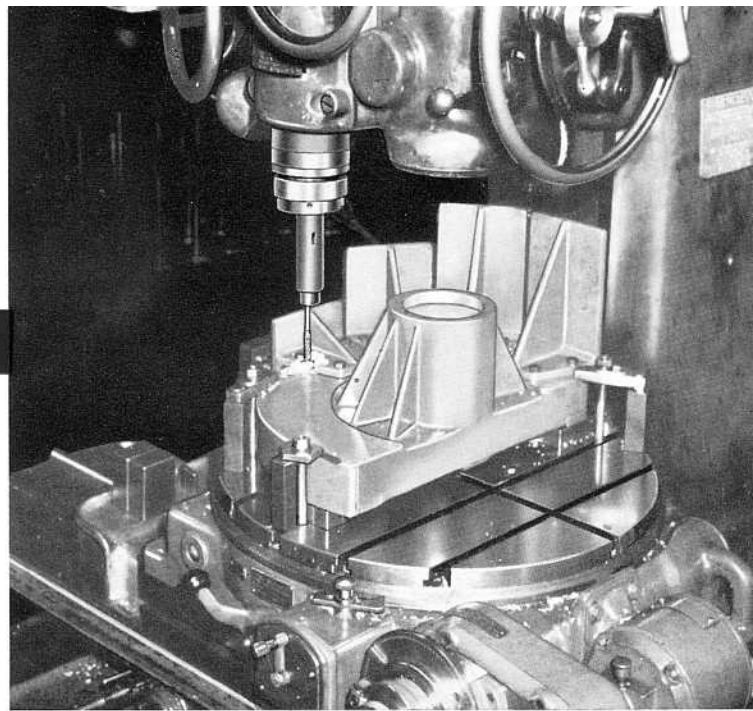


Small jobs like this precision edge cam, or medium size and big jobs such as those shown on page opposite, are accomplished with equal ease and accuracy on P&W Jig Borers. Their fundamentally correct system of measurement and precision construction guarantees accurate results regardless of the size of the job. Their versatility equips any shop to handle both normal and difficult tool production problems faster, better and at lowest cost.

The combination of the P&W Jig Borer's basic lineal spacing method with the fine precision of the P&W Rotary Table provides thousands of opportunities for obtaining exact hole location not only in jigs, fixtures and similar tools, but in production parts and subassemblies too. Here the index plunger holes in a special progressive indexing template carrier for a P&W—Keller machine are being machined with assurance that the radial distance from the center hole and the angular spacing are correct within the allowed limits.

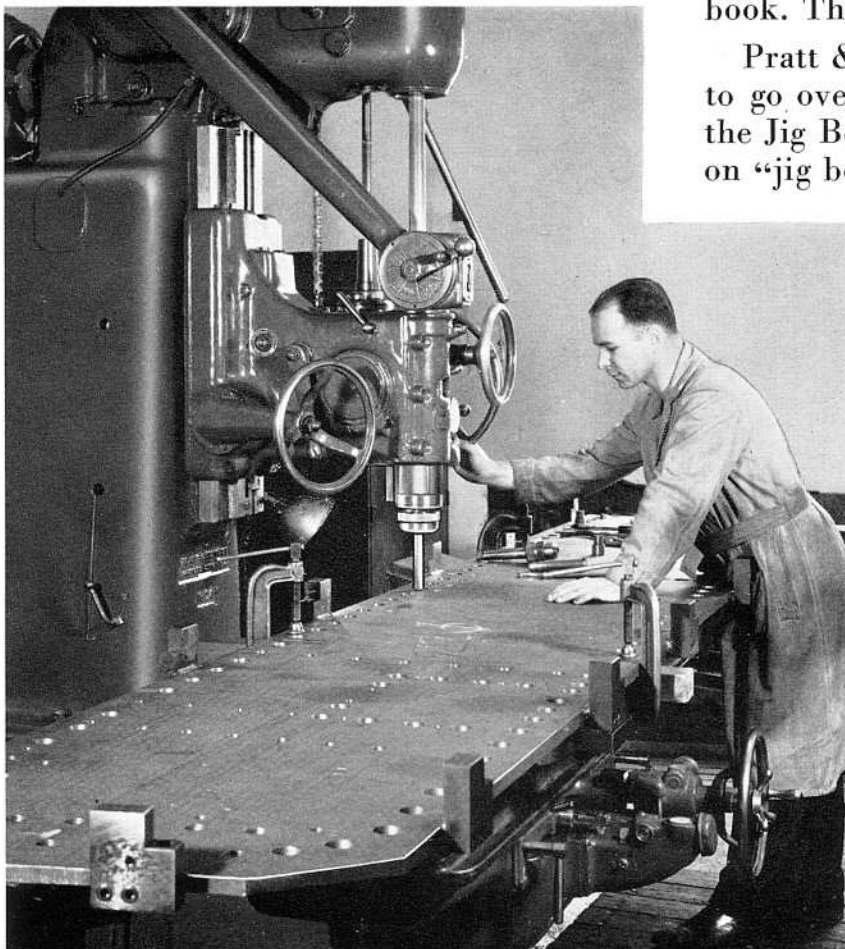
work is produced faster than when tolerances are close, as every good shop man knows. But whatever the precision boring job and its specified tolerances, the Pratt & Whitney Jig Borer will produce it as fast or faster than any other method. P&W Jig Borers have been the accepted standard of precision in hundreds of shops and toolrooms for many years.

The name "Jig Borer" is not a complete description of the work this machine will do. While it is used widely for boring jigs and fixtures and similar tools, it also is used extensively in production as a "Jig Eliminator," performing many small-lot precision manufacturing jobs. (See pages



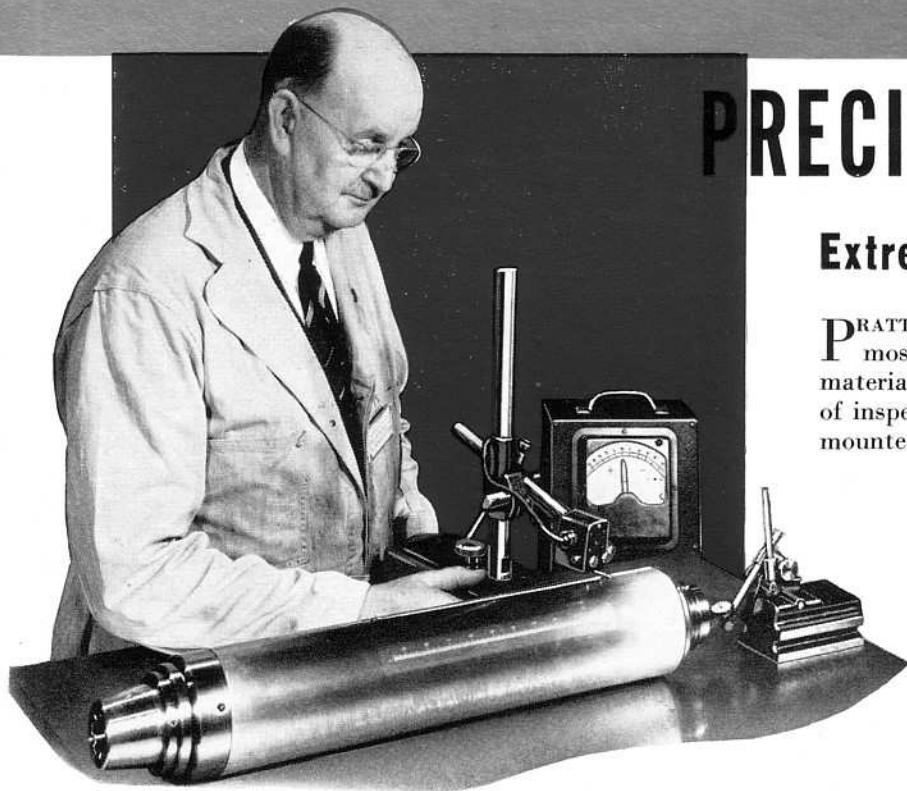
14 and 15.) Due to its open-side design, work can be set up easily on the P&W Jig Borer, and its built-in measuring instruments make layout a simple and accurate operation. In many cases manufacturing can be done completely on the Jig Borer at large savings, and without special tooling. Several such jobs are shown in this book. They are worth investigating.

Pratt & Whitney engineers will be glad to go over your work and show you what the Jig Borer could do in your shop, both on "jig boring" and "jig eliminating."



It's all in the day's work for the shop or toolroom that has the right precision boring equipment. Whether it's big stuff like this large drill jig with many holes and fairly wide limits, or fussy jobs with "tenth" tolerances, the P&W Jig Borer gives dependable basic accuracy. It's wise to invest in REAL jig borers that consistently produce top precision — that impose no restrictions on your profitable operation.

**FOR OTHER INTERESTING
PRECISION LOCATING AND
BORING JOBS LIKE THIS,
SEE PAGES 30 AND 31**



PRECISION BUILT FOR

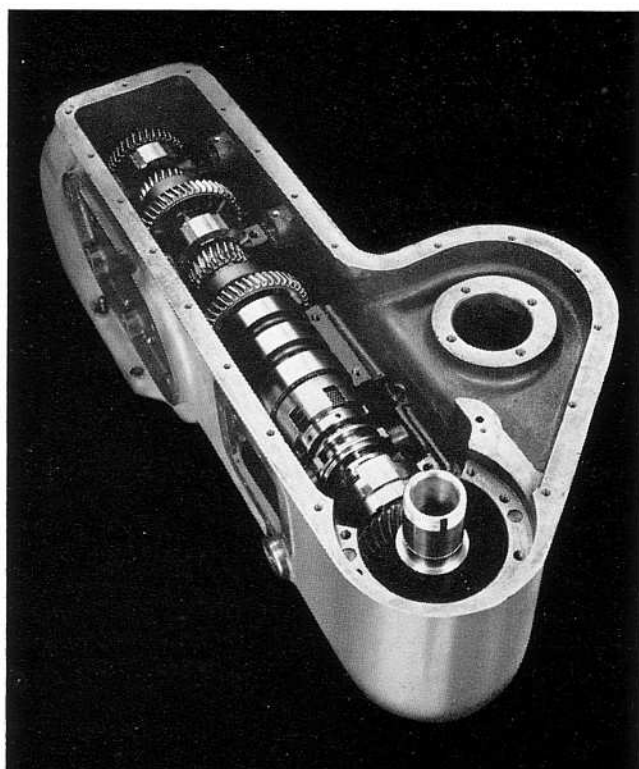
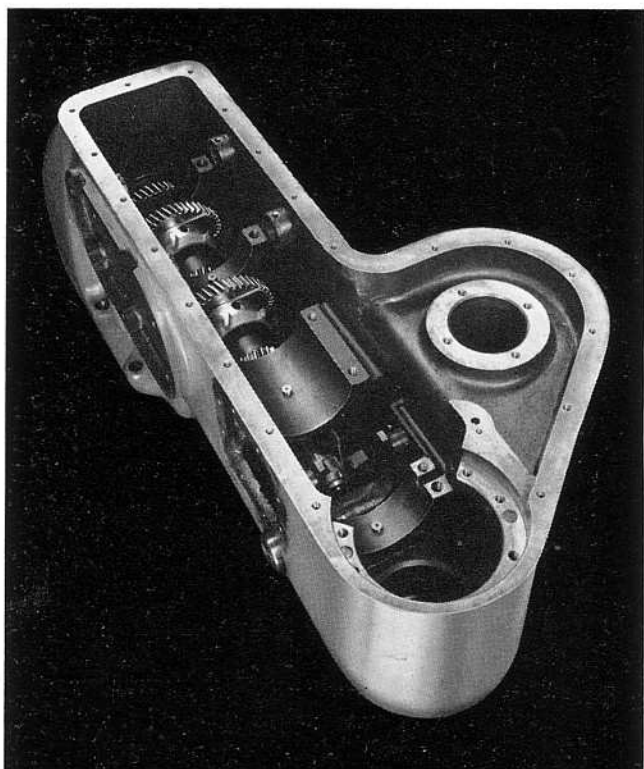
Extremely Accurate Spindle Quill

PRATT & Whitney Jig Borer Spindle Quills are the most accurate tool-rotating units that skill, quality materials, painstaking care and high inflexible standards of inspection can produce. In the quill, the spindle is mounted in preloaded super-precision ball bearings — lifetime-sealed in grease. The hardened and ground quill body is precision draw-polished by expert hands to eliminate every high spot and bring surface grain into the direction of quill movement. Meticulous checking to "tenths" produces perfection. Two of the numerous inspections made before assembly in the machine are those shown — parallelism end-to-end and concentricity of taper of collet seat in spindle end.

Ground Helical Gear Spindle Drive

THE two photos below show the details of the smooth, trouble-free helical and spiral bevel gear drive to the spindle on the Nos. 2A and 3B Machines (Spindle drive of the No. 1½B is similar). Of chrome-vanadium and chrome-molybdenum steel — all gears are heat treated and precision ground for maximum efficiency,

smoothness and quietness. The entire mechanism runs in a constant spray of oil. Precision ball bearings are used throughout, and the multi-splined shafts, sleeves, shifter yokes and the like are of ample proportions. This is truly a remarkable drive, time-tested and proved by years of hard, exacting usage.



PRECISION WORK

Hidden Strength Throughout

THE bed of the Jig Borer carries a big load — all of the weight of the machine and the work; and it must support it accurately under variable conditions as the job progresses. That is why P&W Jig Borer beds (carriages, tables and columns too) are scientifically



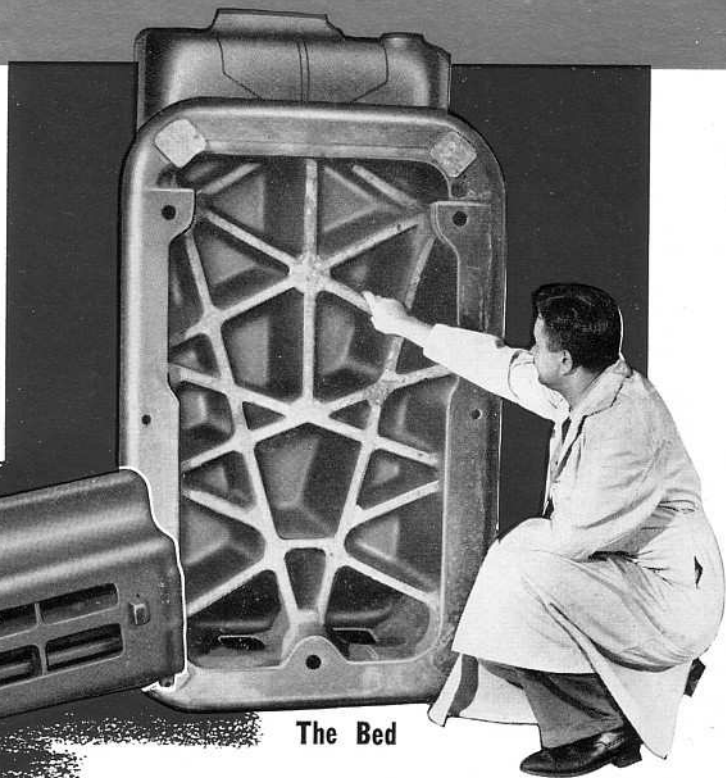
The Carriage

The Table

designed with adequate wall thickness and multiple cross ribbing — with hidden strength to give maximum support and stability under all conditions. Cast of high-grade, close-grained gray iron and normalized to eliminate internal stresses, P&W Jig Borer castings contribute mightily to structural rigidity and operating precision.

Hand Scraped For High Precision

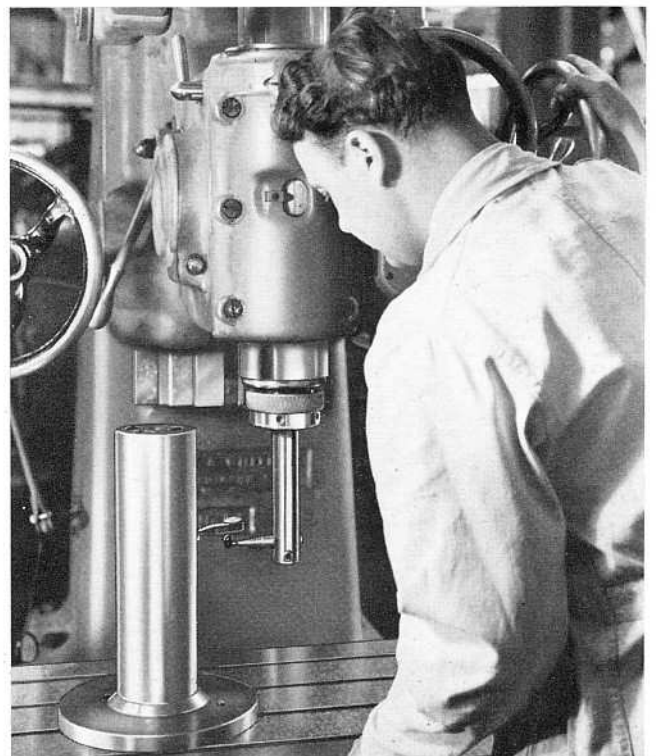
EXTREMELY precise alignment of assembled components and uniformly accurate bearings for all sliding elements are secured through skillful hand scraping by our master craftsmen. Working to inflexible standards for flatness, parallelism, squareness, etc., they produce sparkling surfaces that resist wear and maintain accuracy.



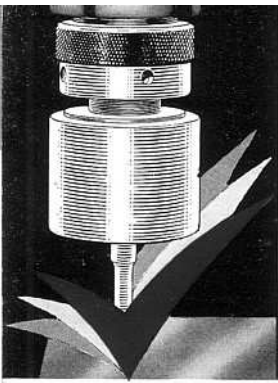
The Bed

Thorough, Careful Inspection

ZEALOUSLY maintained inspection standards are constantly applied to obtain the highest degree of perfection in Pratt & Whitney Jig Borers. This inspector is checking squareness of the spindle with the finished table surface throughout the full travel of the quill — one of many final checks that are made on every machine before shipment.



THE FINEST HIGH SPEED JIG BORERS EVER BUILT



THE ENTIRE SPINDLE HEAD IS AMPLY COUNTER-BALANCED BY A COUNTERWEIGHT INSIDE THE COLUMN ATTACHED TO THE HEAD THROUGH THIS CHAIN.

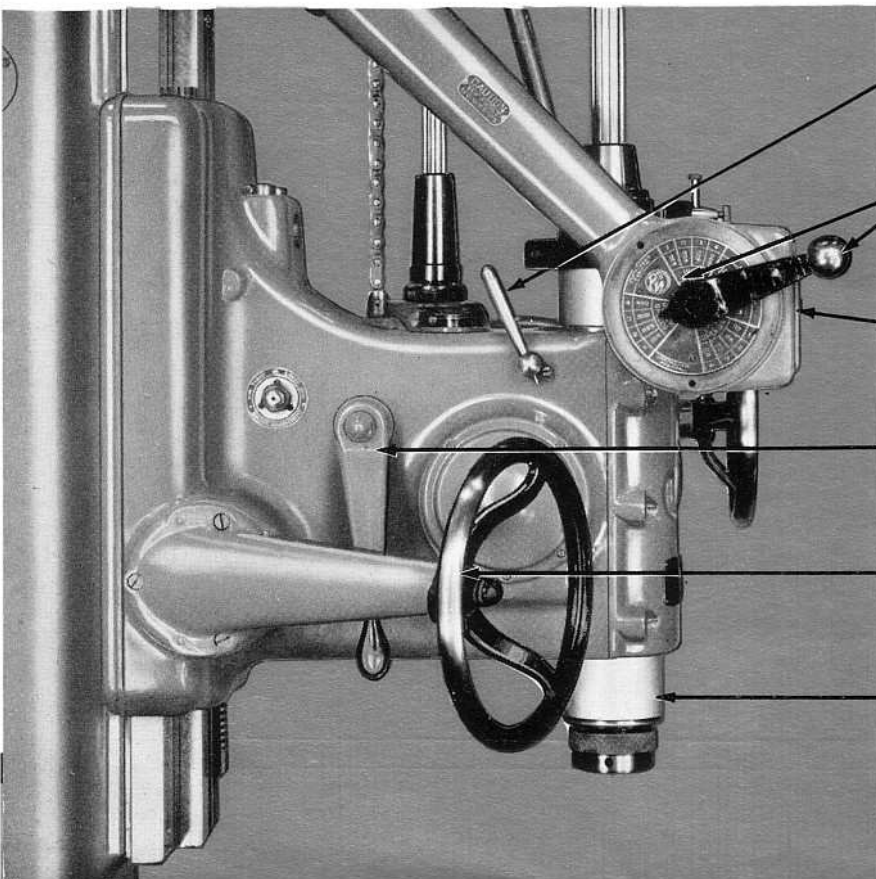
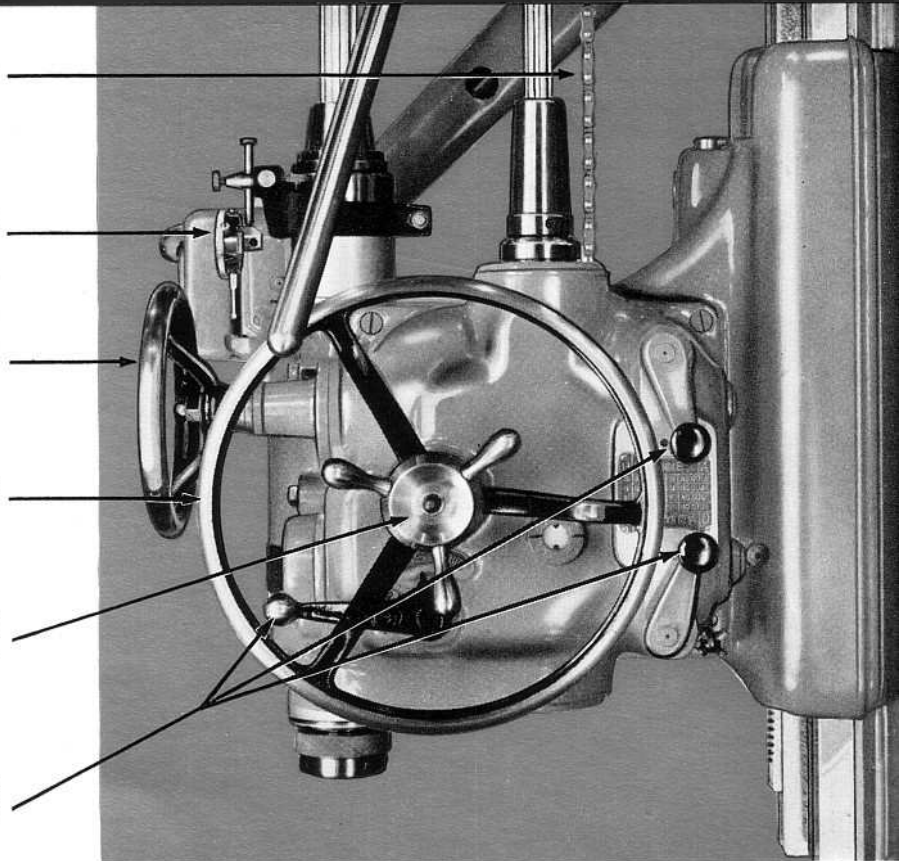
DIAL INDICATOR DEPTH GAGE WITH POSITIVE STOP FOR ACCURATE BORING TO DEPTH.

FINE FEED HANDWHEEL FOR MOVING THE SPINDLE QUILL UP OR DOWN.

RAPID TRAVERSE HANDWHEEL FOR MOVING THE SPINDLE QUILL UP OR DOWN.

THIS KNOB ENGAGES THE POWER FEED, EITHER UP OR DOWN, TO THE SPINDLE QUILL, AND PROVIDES A NEUTRAL POSITION FOR HAND OPERATION.

THESE THREE LEVERS SET THE DESIRED POWER FEED TO THE SPINDLE QUILL. THE POWER FEEDS RANGE FROM .0005" TO .010" IN EITHER DIRECTION FOR EACH SPINDLE SPEED.



BINDER LEVER FOR LOCKING SPINDLE QUILL IN ANY DESIRED VERTICAL POSITION.

THIS LEVER SELECTS ANY ONE OF THREE SPEED RANGES IN THE GEAR BOX WHICH, IN COMBINATION WITH THE FOUR SPEED MOTOR, PRODUCE 12 STANDARD SPINDLE SPEEDS RANGING FROM 37 TO 1800 R.P.M.

CONVENIENT PUSH BUTTON CONTROL FOR STARTING AND STOPPING THE SPINDLE DRIVE MOTOR.

BINDER LEVER FOR LOCKING SPINDLE HEAD IN ANY DESIRED VERTICAL POSITION.

THIS HANDWHEEL RAISES AND LOWERS THE SPINDLE HEAD.

SPINDLE QUILL TRAVEL IS AMPLE FOR LONG HOLES OR HOLES IN DIFFERENT PLANES, WITHOUT RESETTING THE SPINDLE HEAD.

SPINDLE IS DRIVEN BY HARDENED SPIRAL BEVEL GEARS RUNNING IN AN OIL SPRAY. DRIVE IS EXCEPTIONALLY SMOOTH AND QUIET IN OPERATION, AND PRODUCES NO GEAR MARKS ON THE WORK.

MOTOR IS CONNECTED TO SPINDLE THROUGH A 3-SPEED GEAR BOX CONTAINING HARDENED AND PRECISION GROUND HELICAL GEARS WHICH RUN IN AN OIL SPRAY AT ALL TIMES.

FOUR SPEED A.C. OR VARIABLE SPEED D.C. SPINDLE DRIVE MOTOR; STANDARD 600 TO 1800 R.P.M. MOTOR IS MOUNTED UP OUT OF THE WAY, AND IS FREE FROM DIRT AND CHIPS.



THIS SPLINED SHAFT SLIDES THROUGH THE SPIRAL BEVEL DRIVING GEAR AND TELESCOPES INSIDE THE SPINDLE AND QUILL AS THE SPINDLE HEAD AND QUILL ARE RAISED OR LOWERED.

THIS LEVER HAS THREE POSITIONS. IT ENGAGES THE SPINDLE DRIVE CLUTCH AND PROVIDES A NEUTRAL POSITION. IT ALSO APPLIES A BRAKE FOR QUICKLY STOPPING THE SPINDLE, AND FOR LOCKING IT WHEN CHANGING TOOLS.

SPINDLE QUILL CONSTRUCTION MAINTAINS ITS ACCURACY INDEFINITELY. QUILL IS HARDENED, PRECISION GROUND AND DRAW-POLISHED. SPINDLE IS MOUNTED ON PRELOADED SUPER-PRECISION BALL BEARINGS, PERMANENTLY SEALED. FLAT COIL SPRING COUNTERBALANCES WEIGHT OF SPINDLE AND QUILL.

ALL TOOL CHANGES ARE MADE AT THE SPINDLE NOSE. NO DRAWBACK IS USED.

WORKTABLE HAS LARGE PRECISION-SCRAPED SURFACE AND AMPLE T-SLOTS FOR CLAMPING WORK. FRONT AND REAR FACES OF TABLE ARE PRECISION-SCRAPED TO AID IN LINING UP WORK-PIECE ACCURATELY.

NON-INFLUENCING BINDERS LOCK TABLE AND CARRIAGE DURING BORING.

LARGE HANDWHEEL IS FOR RAPID TRAVERSE OF CARRIAGE. KNURLED KNOB ON SIDE OF BRACKET PROVIDES SLOW MOTION FOR PRECISE POSITIONING. CAPSTAN KNOB IN CENTER OF HANDWHEEL ENGAGES SLOW MOTION, AND VICE VERSA.

THIS LEVER CONTROLS THE FOUR SPEED MOTOR AND, IN COMBINATION WITH THE SPINDLE SPEED GEAR BOX, PRODUCES TWELVE STANDARD SPINDLE SPEEDS RANGING FROM 37 TO 1800 R.P.M.

THREE POINT ADJUSTABLE BEARINGS ON THE FLOOR FOR ACCURATE LEVELING.

ACCURATE ALIGNMENT OF TABLE IS ASSURED BY THE WELL-SPACED, PRECISION-SCRAPED WAYS AND GUIDES OF THE BED AND CARRIAGE. CASTINGS ARE THICK-WALLED AND SCIENTIFICALLY RIBBED FOR MAXIMUM SUPPORT OF TABLE AND WORK IN EXTREME POSITIONS.

BROAD WAYS ON THE COLUMN FACE MOUNT THE SPINDLE HEAD, AND A NARROW GUIDE IS PROVIDED FOR ACCURATE ALIGNMENT. THE COLUMN IS HEAVILY RIBBED INSIDE FOR EXTREME STIFFNESS.

LONG BEARING OF SPINDLE HEAD SLIDE ON COLUMN WAYS GIVES SOLID SUPPORT TO THE SPINDLE IN RESISTANCE TO THE FORCES OF THE CUTTING ACTION. STURDY CONSTRUCTION OF ENTIRE SPINDLE HEAD ASSURES MAXIMUM ACCURACY UNDER HEAVIEST LOADS.

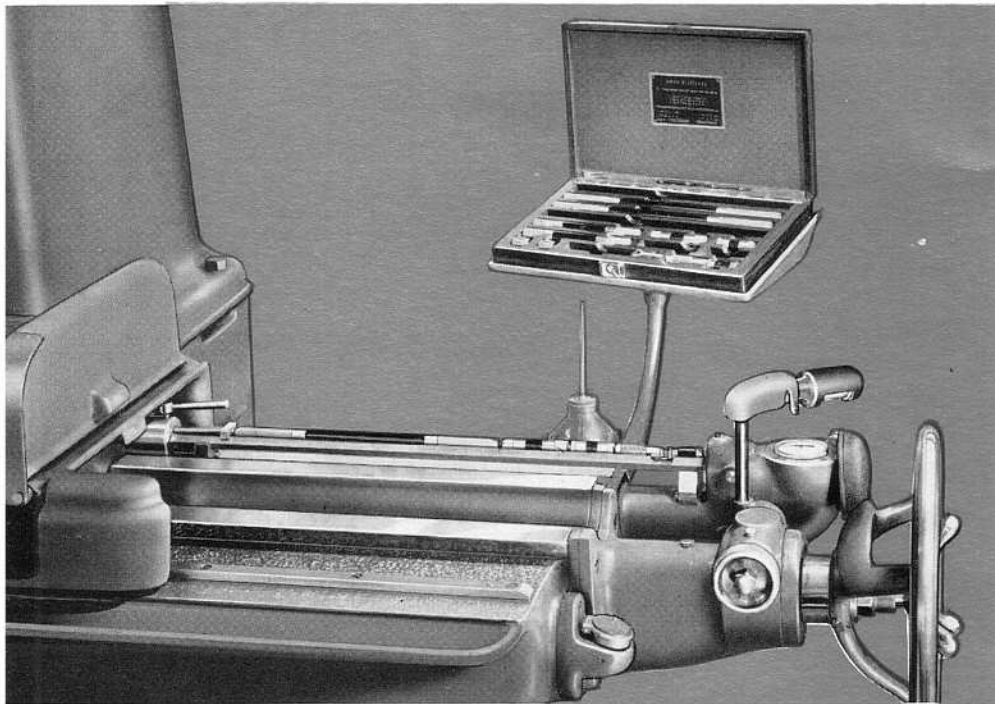
EACH SLIDE (LONGITUDINAL AND TRANSVERSE) HAS A BUILT-IN P&W BASIC MEASURING SYSTEM CONSISTING OF PRECISION END MEASURES, "TENTH" INSIDE MICROMETER, AND DIAL INDICATOR. SEE PAGES 10 TO 13 FOR COMPLETE DETAILS.

ALL END MEASURES AND INSIDE MICROMETERS ARE KEPT IN THIS BOX, CONVENIENT TO THE OPERATOR'S RIGHT HAND

LARGE HANDWHEEL GIVES RAPID LONGITUDINAL TRAVERSE OF TABLE. KNURLED KNOB ON SIDE OF BRACKET PROVIDES SLOW MOTION FOR PRECISE SPACING. CAPSTAN KNOB IN CENTER OF HANDWHEEL ENGAGES SLOW MOTION, AND VICE VERSA.

FUNDAMENTALLY CORRECT

Precision End Measures, Inside



At the left is one of the two slides of a No. 2A Jig Borer with the measuring instruments in place and the "zero point" established. The end measures are for even inches, and the inside micrometer for inch fractions (.0001"). The dial indicator is used only as a pressure gage to maintain the "zero point." These instruments can be rechecked individually at any time without dismantling the machine.

This view also shows the broad precision-scraped ways and dovetail guide of the carriage which maintain the accuracy and alignments originally built into the machine.

THE method of measuring used in the Pratt & Whitney Jig Borer is the fundamental one from which all other systems are derived and calibrated.

The measuring instruments are simple to understand and use. They are instruments which every mechanic knows thoroughly. Even inches are obtained with solid end measures, and fractions of an inch with inside micrometers graduated to read directly to .0001". There also is a sensitive ten-thousandth dial indicator built into each slide. These indicators are used as pressure gages to maintain the "zero point" and a constant measuring pressure. For this reason the measuring system is not dependent in any way on the operator's sense of touch.

The dial indicators show instantly the slightest movement of the table. They maintain a

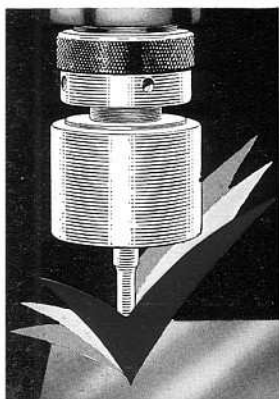
positive check at all times, before, during and after boring.

Each slide is equipped with one of these accurate built-in measuring devices.

How Holes Are Located, Bored and Checked

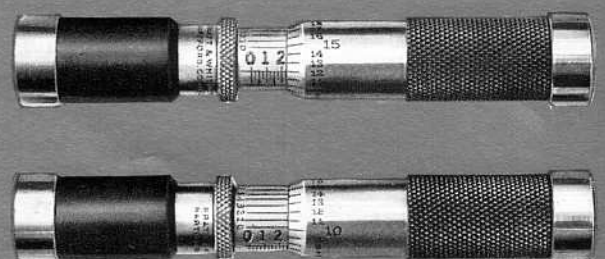
Holes are located by two dimensions at right angles in the horizontal plane, using the two built-in measuring devices, one on each slide. The first hole is located under the spindle by whatever means is easiest according to the nature of the work, usually measuring from a finished edge. With the spindle in proper position to bore the first hole, the table is locked, and the "zero point" for the whole job is established on the two dial indicators. This point does not change, and can always be picked up again exactly by means of the indicators.

To locate the next hole the necessary end measures are inserted for the even inches, the



These two accurate one-inch inside micrometers, one for each slide, read directly to .0001". They provide any desired fractions of an inch, and may be locked at any setting. One has a red band and the other a green to distinguish them apart. In addition, the measuring troughs in which they are used are marked with corresponding colors so that the same micrometer is used in the same trough each time.

10



SYSTEM OF MEASUREMENT

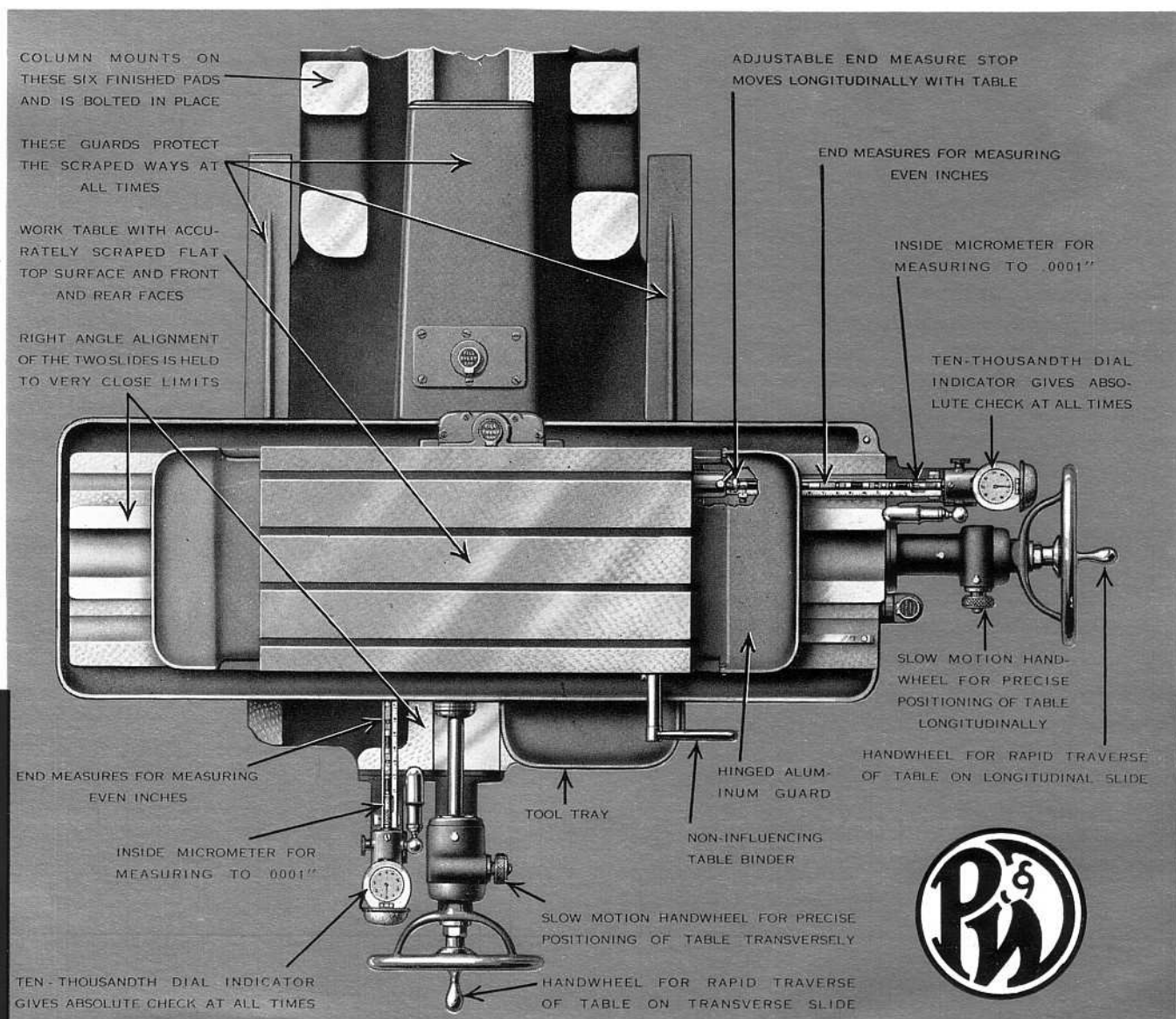
Micrometers and Dial Indicators

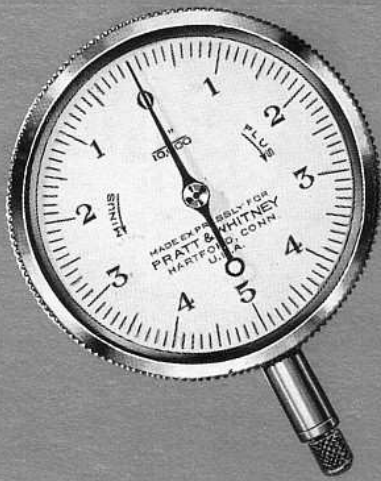
inside micrometers set for the inch fractions (accurate to .0001"), and the table moved until the dial indicators on the slides register the "zero point." The slow motion knobs make this fine table adjustment easy. The traversing screws of the two slides have no connection with the measuring system, therefore errors in the screws themselves, backlash or wear cannot affect the accuracy of the setting in any way. The dial indicators are not used for obtaining any part of the required dimension. They are only for establishing and maintaining the "zero point" exactly. Clamp the table in place, recheck the setting, and the next hole is ready for boring. Any number of holes can be located, bored and checked in this manner. The carriage and table binders are of a special "non-influencing" design which will hold tightly without distorting the setting in the least.

(continued on page 12)



A complete set of precision end measures and two .0001" inside micrometers — all contained in a compact mahogany box — are furnished with each machine. This is the set for the No. 3B Jig Borer. End measures are made by Pratt & Whitney from selected steel — hardened, seasoned and finished to close tolerances at standard temperatures of 68° F. End gaging surfaces are parallel to each other and concentric with the diameter.





This is one of the ten-thousandth dial indicators built into each slide. It is not used for measuring, but is a very sensitive pressure gauge to maintain the "zero point." These two dials are the "watch dogs of accuracy." The slightest change in table position shows on them instantly, and can be corrected before the work is spoiled. They are made expressly for use in the P&W Jig Borer.

Dimensions are set on the machine exactly as they appear on the drawings to which the operator is working (See below and page 13). He does not have to add or subtract measurements. He establishes a "zero point" for the first hole, and then reproduces the drawing dimensions on his measuring instruments, working from that "zero point."

The visible assurance of ten-thousandth accuracy on the dial indicators is a most valuable precision boring feature. It is this that makes P&W Jig Borer accuracy so dependable. It is impossible for any slight change to occur in the table position without being apparent instantly on the indicator dials. Not only does this guarantee the finest accuracy, but it cuts the spoiled work bill to shreds by warning the operator before he has finished.

Often jobs are checked by the inspector before being removed from the machine. More than once the Pratt & Whitney Jig Borer has been used to inspect work done on other machines. Frequently it is used for laying-out work to be done elsewhere, as the measuring instruments are ideal for this purpose.

TYPICAL JIG BORER DRAWING

Correctly Dimensioned

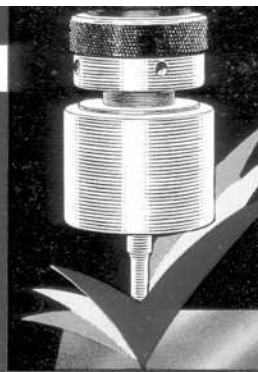
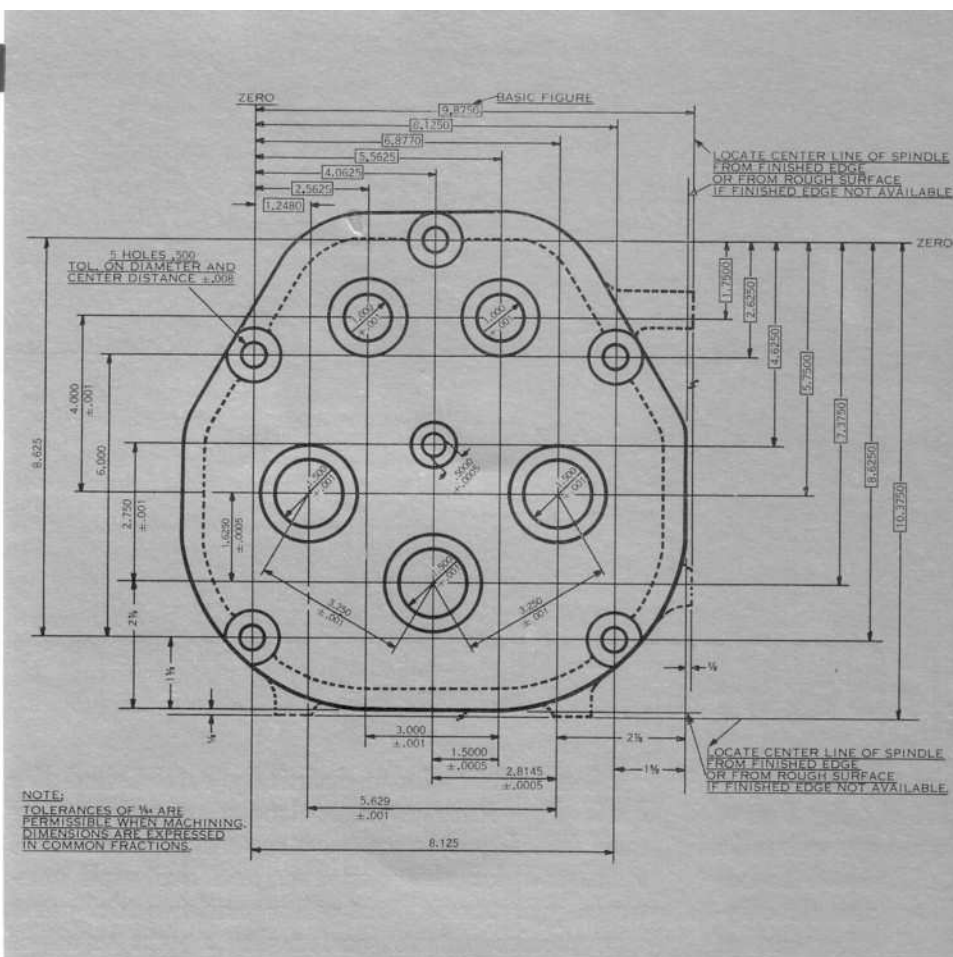
A Jig Borer Operator is paid to turn out precision work rapidly. The P&W Jig Borer is designed for fast accurate production. But when the jig borer must stand idle while the operator sits at a bench doing "shop mathematics," the whole system breaks down and much valuable time is lost. Added to this is the probability that even an expert operator will make errors occasionally if he has to refigure his drawing dimensions in order to locate them on his machine.

That is why we recommend to engineering draughtsmen a particular method of making drawings for jig borer work. This method will eliminate "shop mathematics," because dimensions can be set directly on the jig borer, and no extra calculations are needed. With all figures checked in the draughting room the possibility of mathematical error is greatly reduced, and the operator freed of responsibility. At first glance, this method of dimensioning drawings

seems reversed to most engineering draughtsmen, but a little study will prove it correct.

The drawing on the next page is a hypothetical illustration of a typical part which might be produced in small quantities on a Pratt & Whitney Jig Borer. Similarly the same holes might be incorporated as part of a box jig, later to be used in producing this piece by production methods. It must be remembered that the dimensions on this drawing are those which will be needed for the jig borer and the subsequent inspection. All the dimensions needed for the pattern maker and preliminary machining are not included, but these will come under standard draughting room practice. We purposely have shown only the jig borer figures to illustrate exactly what the jig borer operator needs to complete his work without shop mathematics.

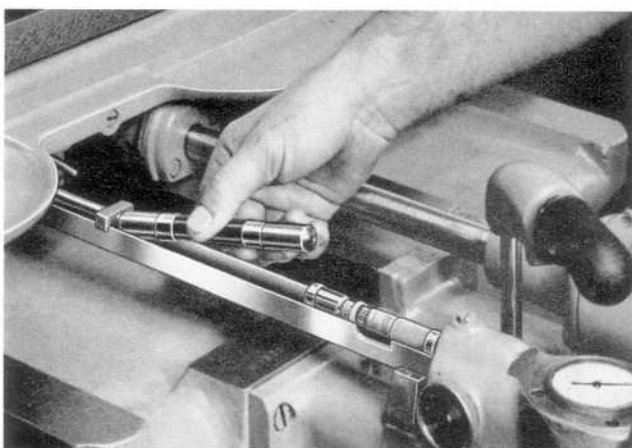
We have shown working lugs on the right and bottom sides. Presumably these lugs would be removed after the piece is finished. The piece



This is a correctly made Jig Borer drawing for a hypothetical machine part. The dimensions in boxes are basic figures used by the operator to set his instruments. The others show the operator the required accuracy of the various holes and are for the inspector's use. All dimensions should be worked out in the engineering department in advance, to eliminate any need for mathematics by the jig borer operator. All holes are located from zero lines at the left and the top (rear of work as you look down on the jig borer table).

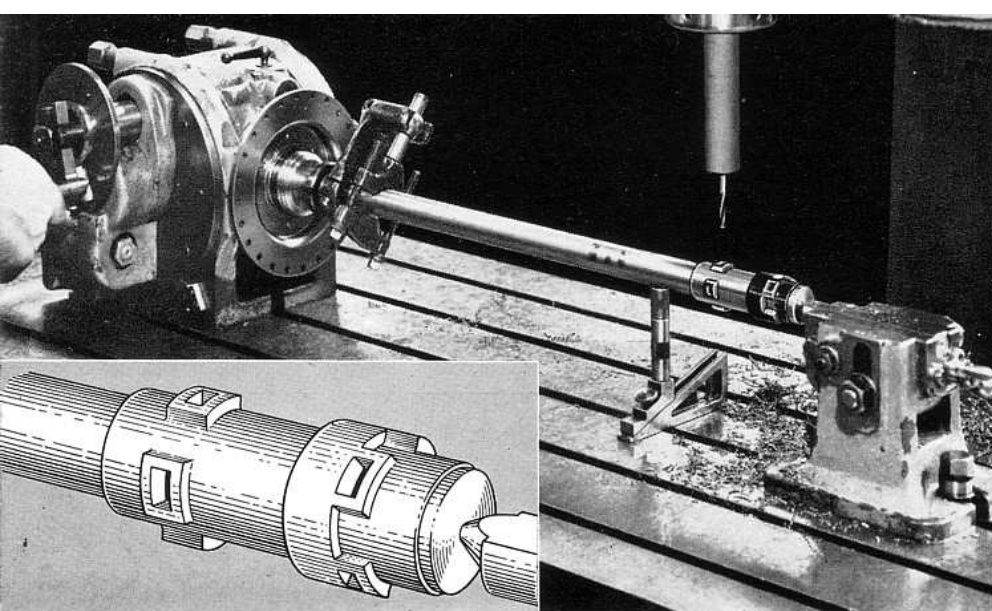
would be squared up with the front face of the jig borer table using these finished lugs. Their location can be anywhere that is most convenient, remembering that the operator must use his finished table surfaces for locating. The piece could be located from a rough surface or from any finished edge according to what is desired and available.

Pratt & Whitney Jig Borer measuring devices have no connection with the table or carriage traversing screws. Therefore errors in screws, wear, or backlash can never affect the accuracy of hole location. Photo shows operator laying correct end measure in the trough while making a transverse setting of the carriage.



The main point is that all dimensions for the holes are located from a zero line at the rear and one at the left. This permits the operator to move from one hole to any other merely by inserting the correct end measures and setting his inside micrometers. He does not have to subtract any dimensions, but can set directly from the drawing. This enables him to follow good drilling and boring practice whereby he would finish holes on opposite sides of the piece successively. This avoids excessive distortion from heat or from strains in the metal relieving by machining. Good practice would have the operator first rough drill all holes and then go back to complete the finish reaming or boring operation according to the limits involved.

On the drawing the dimensions enclosed by rectangles are basic figures and do not show tolerances. These are the dimensions the operator uses to set his built-in measuring instruments on the machine. The dimensions not enclosed in rectangles show the required tolerances. They serve the double purpose of aiding the operator to select the proper method of finishing the holes to produce the specified tolerances, and also enable the inspector to properly check the finished job.



FOR TOOLROOM PRECISION BORING AND . . .

Jig Borer accuracy plus a precision index head saved time and fixture cost on experimental tubular piston rods. Two rows of rectangular openings, (.250" x .375") 2.500" apart and offset 45° were spotted, drilled and milled out to close limits. Corners were squared on a P&W Vertical Shaper.

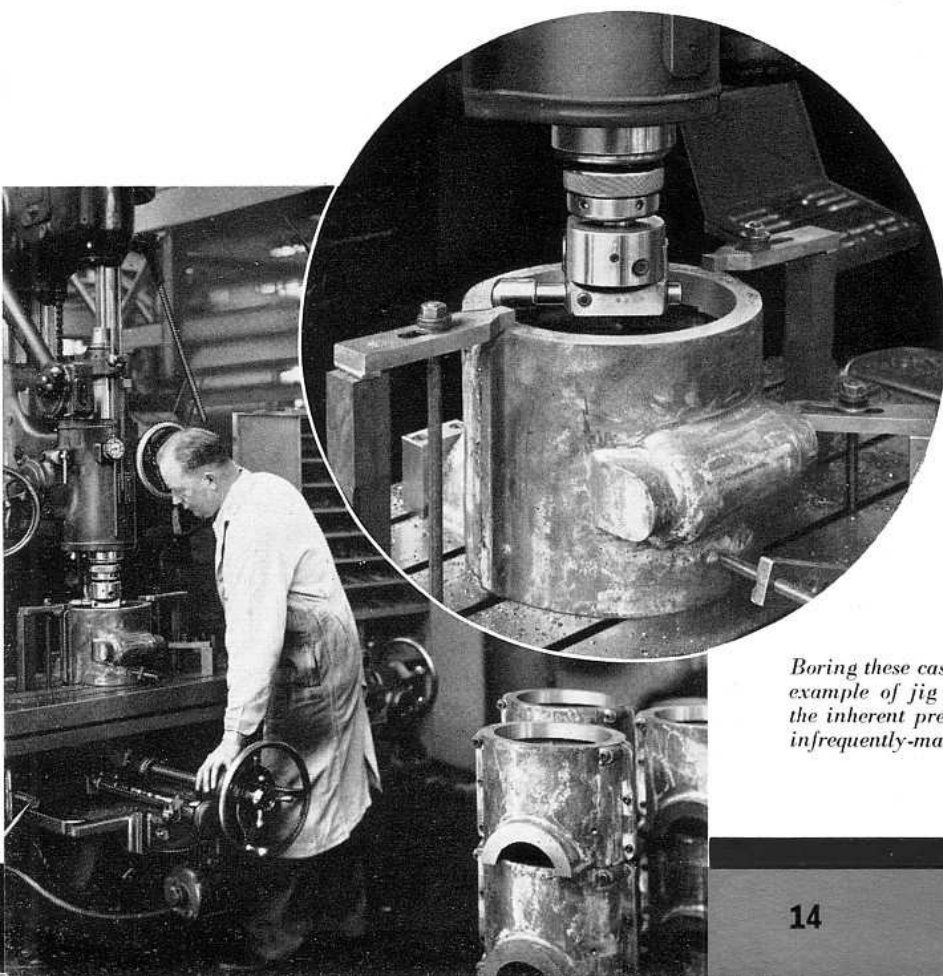
. . . FOR ECONOMICAL SMALL-LOT

MAKING jigs and fixtures is not the only function of a Pratt & Whitney Jig Borer, even though that kind of work always exists in large quantities. "Jig Eliminator" would be another good name for this machine, and descriptive of the other work it will do. Instead of building up special tooling for small-lot manufacturing, the work itself frequently can be finished entirely on the P&W Jig Borer. This includes a wide variety of drilling, reaming, boring, chamfering and light milling operations, all performed with the fine accuracy of Jig Borer practice.

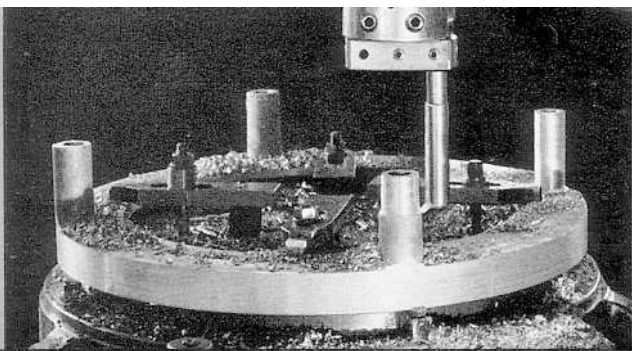
Many plants have definitely established the P&W Jig Borer as a toolroom manufacturing machine. In our own shop several machines are employed for this purpose, and are used continually in turning out other machine tool parts of a precise nature, performing a part or all of the necessary operations. Savings of forty and fifty percent have been effected in this manner, and better and faster jobs obtained.

The open-side construction of the P&W Jig Borer makes it an ideal machine for short-run manufacturing. The large work capacity and ample facilities for easy setup are characteristic of this design. Most important of all is the visible assurance of ten-thousandth accuracy at all times. It is this that makes the accuracy of the P&W Jig Borer so dependable, and which has eliminated so much checking time on finished work. It is impossible for any slight change in the position of the table to occur without being apparent instantly on the indicator dials. Not only does this guarantee the finest accuracy, but it cuts the spoiled work bill by warning the operator before he has finished the job.

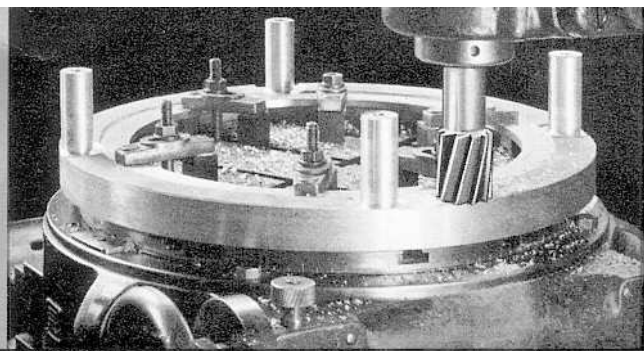
On these two pages are several jobs illustrating "jig eliminating." They can



Boring these cast iron split housings for large printing presses is a typical example of jig eliminating. Simple work locators and hold downs plus the inherent precision of the machine gave the necessary accuracy to these infrequently-made parts with no tooling cost.



The above photos are of an aluminum piece used in a precision instrument, which requires an accurate fit with its component parts. The Pratt & Whitney Jig Borer, equipped with a Rotary Table for indexing, was used to turn the posts, to mill the flat surfaces, and to drill and precision-bore the holes in each of the posts. All three of these operations were done from the same table setup. This



machine showed a pronounced saving over other methods. Without removing the piece, the final inspection was made, and each operation was found to be well within the necessary close tolerances. This job is typical of many coming into the toolroom where the versatility and precision of P&W Jig Borers prove a sound investment.

PRECISION MANUFACTURING

be studied with profit by the shop executive who must produce accurate work in small lots at low cost. And he should bear in mind, the Pratt & Whitney Jig Borer locates to "tenths," bores where it locates and then accurately and positively checks the work, all in the same table setup.

Frequently a toolroom executive believes that he lacks sufficient work to warrant installing a P&W Jig Borer. If he looks *only* at his jig and fixture production he may be right. But add to that the possibilities opened up by "jig elimination" and the situation becomes very differ-

ent. Often we have found in such cases that the Jig Borer becomes the most used machine in the toolroom, constantly in demand, and paying for its cost in a remarkably short time. The best proof of any machine's ability and economy — its "worth" — is the work it can do.

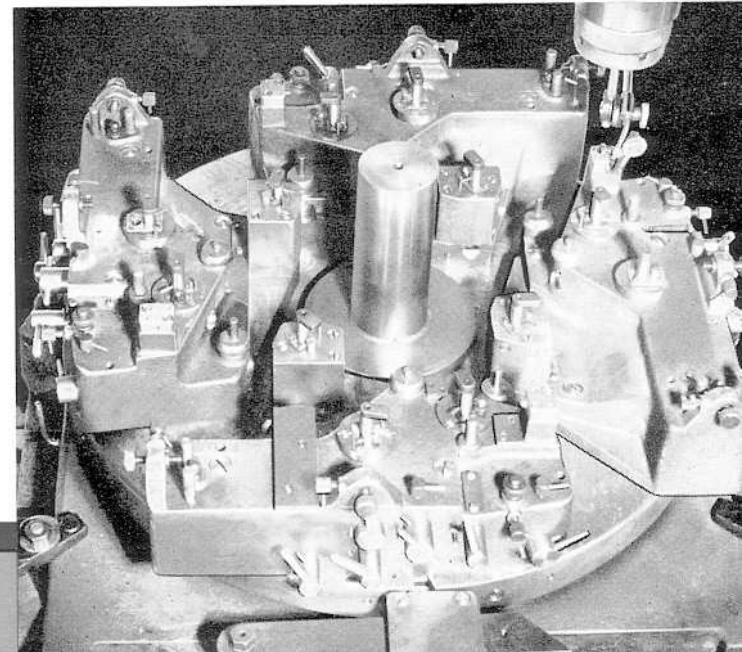
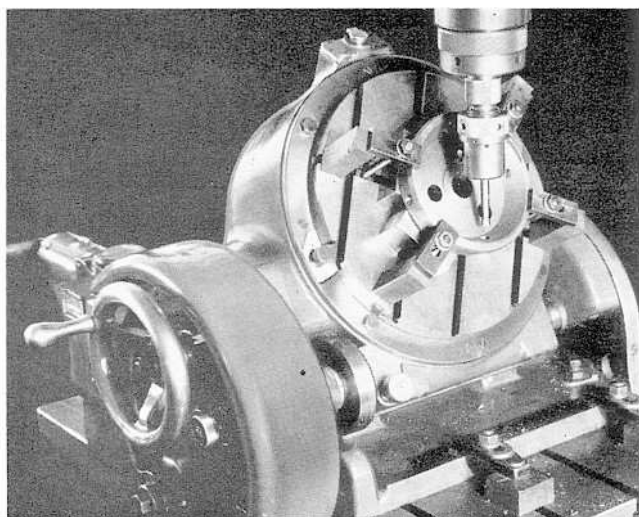
It is best to see the P&W Jig Borer in action to know *all* it can do. We can tell you of a nearby installation which we can arrange for you to visit. At our own factory we can show you the exquisite precision we build into every part. Our engineers will be glad to go over your work from the standpoint of "jig elimination."

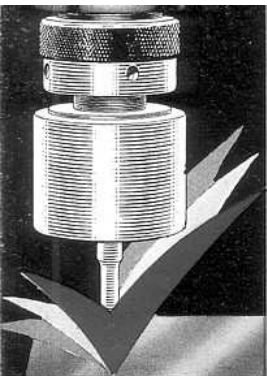


A typical Tilting Rotary Table application, boring four equally spaced $\frac{3}{16}$ " holes around a circumference at exactly 30° with the vertical. This precision job would have been very difficult without such equipment. The other five holes were bored with the table in a horizontal position without any necessity for reclamping the work-piece. This Tilting Rotary Table is described on page 16.

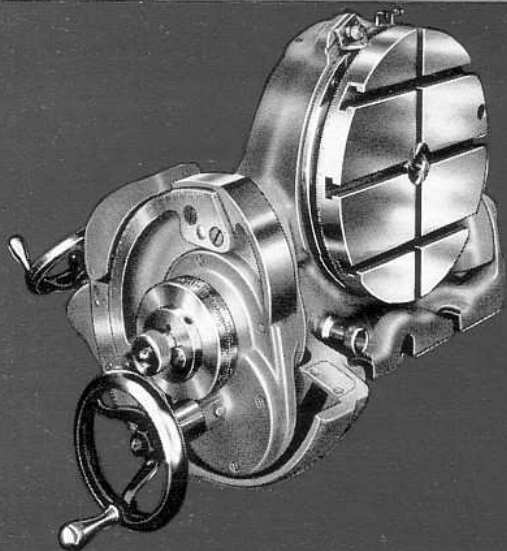


This is a four-station indexing table for an automatic machine which was completely assembled on the P&W Jig Borer. Each piece was located in place using the measuring instruments, and then drilled and reamed for dovetailing and fastened into position. The saving over conventional assembly methods was approximately 50%. Many times the P&W Jig Borer can be used on assembly work.





ADDITIONAL TILTING ROTARY TABLES

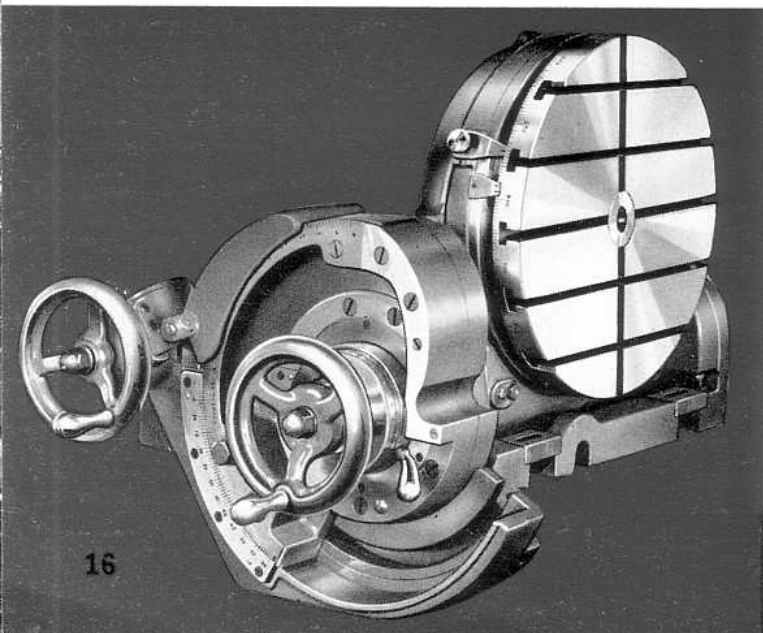


10 Inch for No. 1 1/2 B JIG BORER

When a 10" Tilting Rotary Table is to be used on the No. 1 1/2 B Jig Borer, a 6" Raising Block should be fitted under the column in order to take full advantage of the capacity of the machine at maximum tilt of the table. This increases the minimum distance from spindle end to regular table top from the standard 3" to 9" at those times when the Tilting Rotary Table is not in use. To compensate for this increase and to restore the original convenient working distances on thin workpieces, a 6" Subtable (size 12" x 24") can be supplied.

16 Inch for Nos. 2A and 3B JIG BORERS

On the No. 2A Jig Borer, when the dimensions of the work approach the 16" diameter of the Tilting Rotary Table, a Raising Block should be fitted under the column in order to take full advantage of the capacity of the machine at maximum tilt of the table. This increases the minimum distance from spindle end to regular table top when the Tilting Rotary Table is not in use. To compensate for this increase and to restore the original convenient working distances on thin workpieces, a Subtable can be supplied. Raising Blocks and Subtables of suitable heights are obtainable to meet requirements. The foregoing does not apply to installations on the No. 3B machines.



THE working surface of the P&W Tilting Rotary Table can be set at any desired angle from horizontal to vertical, and is rotatable through 360° in the plane to which it is tilted. It is a great timesaver on jobs which require holes bored accurately on angles, whether "simple" or "compound," or where work must be indexed accurately, or any combination of the two. Several applications of such work are illustrated in this book, some of which would have been very difficult or impossible to do without such equipment.

The table bolts in place on the regular rectangular table of the machine, and can be set up or removed easily. It also is available for other types of machines requiring this type of equipment.

The outer edge is graduated in degrees for quick indexing, using the rapid traverse hand-wheel. Accurate setting is by means of a large dial graduated in minutes, with a vernier which subdivides to two seconds.

Tilting is accomplished by a second hand-wheel, using graduations in degrees on the quadrant face for rough setting. A vernier on this scale subdivides to one minute. Binders lock both the rotary and tilting movements solidly during boring.

The table surface is precision-ground flat and is provided with ample T-slots for holding down work. A proving bar is furnished for accurately centering the table under the machine spindle. Complete specifications are listed below.

SPECIFICATIONS

	10 Inch	16 Inch
Working surface diameter.....	10"	16"
Table height, horizontal position.....	6 1/2"	8 1/2"
Maximum tilting range above horizontal...	90°	90°
Machine table to center of Rotary Table at maximum tilt.....	7 5/16"	11 13/16"
Number of parallel T-slots.....	3	5
T-slots center to center.....	3"	2 3/4"
Size of T-slots.....	7/16"	9/16"
Tilting graduations.....	In degrees	
Tilting vernier graduations.....	One minute	
Table graduations.....	In degrees	
Table dial graduations.....	One minute	
Table dial vernier graduations.....	Two seconds	
Net weight, approximate lbs.....	200	600
Furnished with proving bar, chart, one gage for angular setting, hold down straps and T-bolts.		

EQUIPMENT

PLAIN ROTARY TABLES



THE P&W Plain Rotary Table is machined, assembled and inspected with exactly the same skill and precision as is the Jig Borer on which it is used. Besides adding versatility and speed to Jig Borer operation, it affords a convenient and inexpensive means of obtaining precise circular indexing and the laying-out of work requiring the use of polar co-ordinates.

The working surface is precisely ground and is assembled parallel with the accurately scraped undersurface of the body casting. The hardened and ground center bushing is accurately located in the center of the table and is square with the table surface. The periphery of the table is graduated in degrees for approximate settings, and a rapid traverse handwheel is provided for this purpose. For exact settings there is a small slow-motion knob which, with the large graduated dial, permits accurate settings to five seconds.

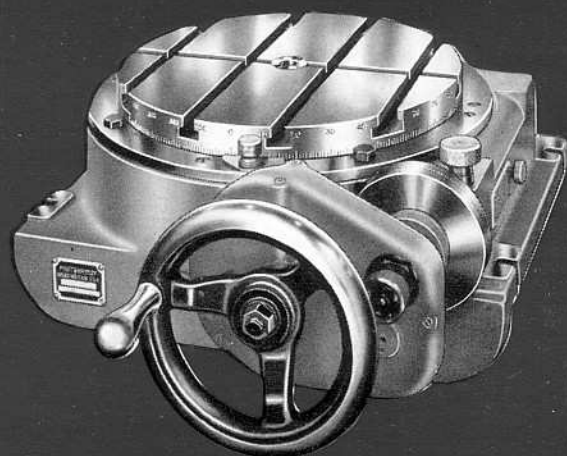
The table bolts in place on the regular rectangular table of the machine and is quickly set up or removed. It is also available for use on other types of machines requiring this kind of equipment, and for use on large surface plates in experimental laboratories and inspection departments.

The working surface is provided with ample T-slots for holding down work, and a proving bar is furnished for accurately centering the table under the machine spindle. Complete specifications are listed below.

SPECIFICATIONS

	12 Inch	20 Inch
Working surface diameter.....	12"	20"
Table height.....	4 3/4"	7"
Number of parallel T-slots.....	4	5
T-slots center to center.....	3"	3 1/2" & 3"
Size of T-slots.....	7/16"	9/16"
Table graduations.....	In degrees	
Table dial graduations.....	One minute	
Table dial vernier graduations.....	Five seconds	
Net weight, approximate lbs.....	152	450
Furnished with proving bar, hold down straps and T-bolts.		

*Measured from centerline out.



12 Inch for No. 1 1/2 B JIG BORER

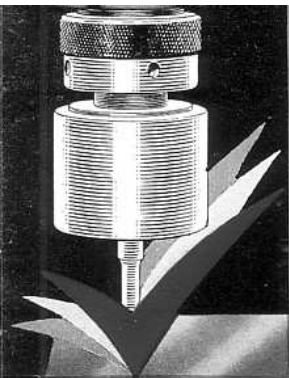
The rapid traverse handwheel provides 9° of table rotation per revolution through a 3 to 1 gearing ratio to the hardened and ground worm. The worm meshes with a high-accuracy wormwheel cut into the periphery of the table itself by a special process. This speed-up is of particular advantage when settings are widely spaced. The working surface is precision-ground and assembled parallel with the scraped undersurface of the body.

ALL PRATT & WHITNEY ROTARY TABLES ARE HELD WITHIN A CIRCULAR SPACING TOLERANCE OF ± 10 SECONDS IN ANY 10 DEGREES OF ROTATION AND ± 15 SECONDS IN 360 DEGREES OF ROTATION.

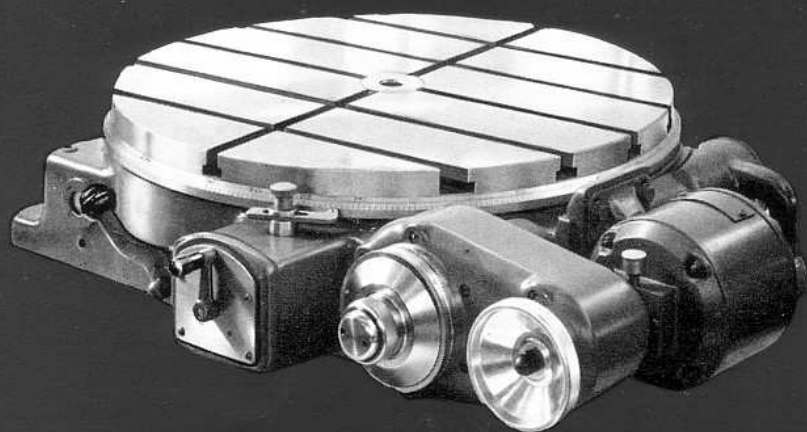
20 Inch for Nos. 2A and 3B JIG BORERS

Besides adding versatility and speed to Jig Borer operations, this table can be used advantageously on other machines and in inspection work where precise angular indexing is required. The hardened and ground worm meshing with the high-accuracy wormwheel (specially cut in the periphery of the table itself) is turned directly by the rapid traverse handwheel and gives 3° of table rotation per revolution. Working surface is precision-ground.





ADDITIONAL EQUIPMENT



24 Inch for Nos. 2A and 3B JIG BORERS

MOTOR DRIVEN PLAIN ROTARY TABLES

THESE tables are self-contained, motor-driven units. The table top is ground within .0005" parallel to the accurately scraped lower surface. The hardened and ground center bushing is accurately located in the center of the table and is square with the table surface within .0002". A $\frac{1}{4}$ H. P. reversible motor provides power rotation in either direction, giving very rapid indexing and saving valuable operating time.

For approximate indexing, graduations are legibly marked in degrees on a beveled edge throughout the entire periphery of the table. Precision settings to minutes and seconds are obtained instantly through the slow motion hand control of the vernier dial. As with all other Pratt & Whitney Rotary Tables, these tables will index in either direction from zero and return to the original zero within a spacing tolerance of ± 15 seconds in the full 360 degrees of rotation. This is due mainly to the extreme precision of the hardened and ground worm and the specially cut wormwheel.

All internal mechanism and the table center bearing are maintained on super-precision ball

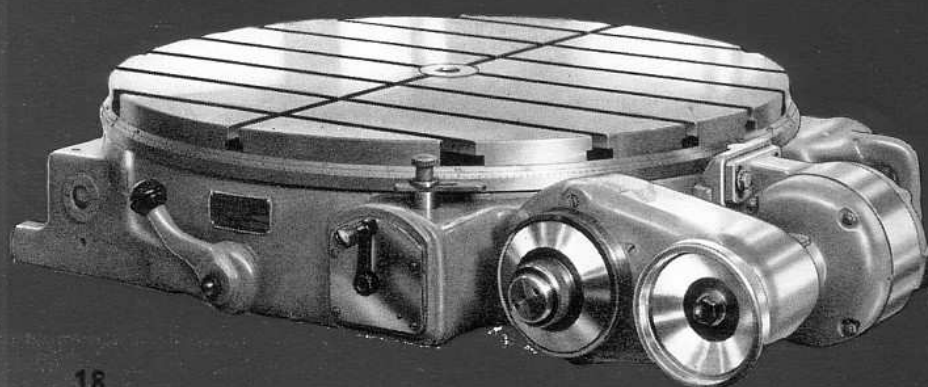
bearings and lubricated from one central reservoir. The worm is always in mesh with the wormwheel, eliminating all bruises and wear usually accumulated from engagement and disengagement. The table is locked in boring position by a single binder, so designed that it produces no distortion of the table surface.

The 24-inch Table is used on either the No. 2A (2430) or No. 2A (3644) machine, and the No. 3B machine. The 30-inch Table is used on the No. 2A (3644) and the No. 3B machine. Complete specifications are listed below.

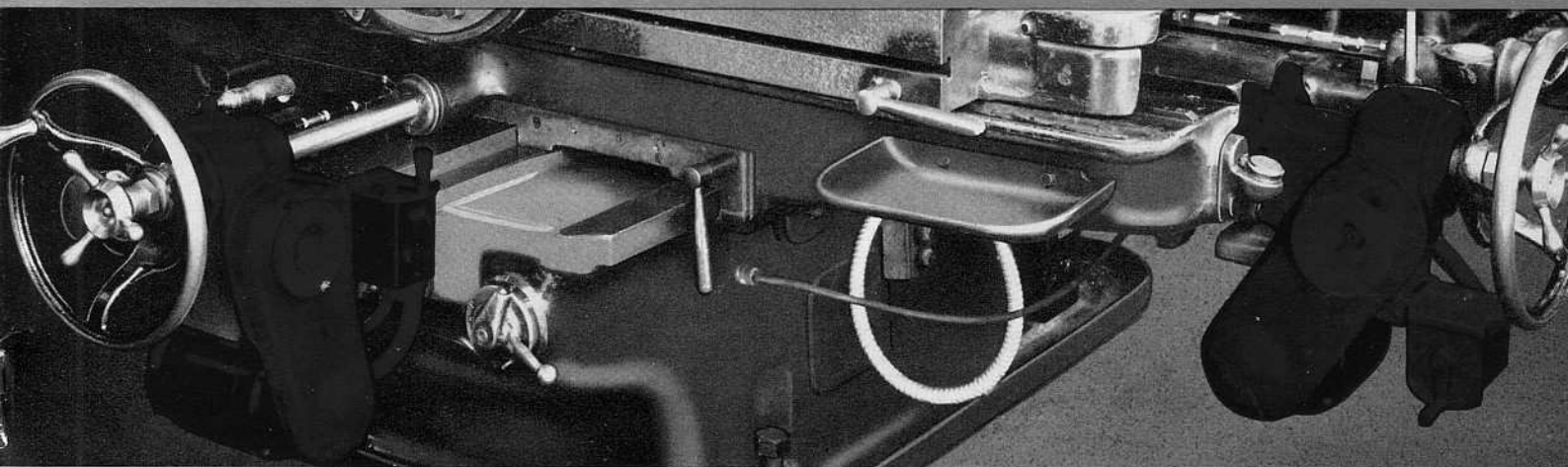
SPECIFICATIONS

	24 Inch	30 Inch
Working surface diameter.....	24"	30"
Table height.....	7"	8"
Table graduations.....	In degrees	
Table dial graduations.....	One minute	
Table dial vernier graduations.....	Two seconds	
Number of parallel T-slots.....	5	7
T-slots center to center.....	4"	4"
Size of T-slots.....	$\frac{9}{16}$ "	$\frac{9}{16}$ "
Net weight, approximate lbs.....	700	925
Furnished with $\frac{1}{4}$ H.P. reversible motor, completely wired, suitable pull plug connection to machine carriage, proving bar, hold down straps and T-bolts.		

30 Inch for Nos. 2A (3644), and 3B JIG BORERS



The 30-inch motor-driven Plain Rotary Table is of the same design as the 24-inch Table shown above, except that it has seven parallel T-slots instead of five, and is proportionately larger. Both of these tables are extremely accurate, and besides adding versatility and speed to Jig Borer operation, they find many applications on other types of equipment where accurate indexing is required. Non-influencing table binder lever, directional motor controller and the vernier dials and handwheel are conveniently grouped at the right-front for maximum operating convenience.



POWER TRAVERSE UNITS

For No. 2A (3644) Jig Borer Only

THE No. 2A (3644) Jig Borer can be fitted with Power Traverse Units that provide rapid power movement of the table longitudinally and of the carriage transversely. These units offer great opportunities for savings in time and operator fatigue where the usual run of work handled on the machine is long or wide, or both, with lengthy traverses between settings. Either one or both of the power units may be applied according to the particular need. We prefer to install them on new machines before shipment, but they can be added to machines already in the field at additional cost.

Providing a rapid movement of approximately 60 inches per minute, these compact power units bring the work to approximate position quickly and effortlessly, with exact setting being made with a slow-motion knob located on the side of the housing. The procedure for using the P&W measuring system is the same as on the regular machine. The large handwheels for hand positioning may be used when desired.

Motors are $\frac{1}{4}$ H.P. for the table and $\frac{1}{2}$ H.P. for the carriage, each controlled by conveniently located directional switch handles.



No. 3B JIG BORER with BUILT-IN ROTARY TABLE

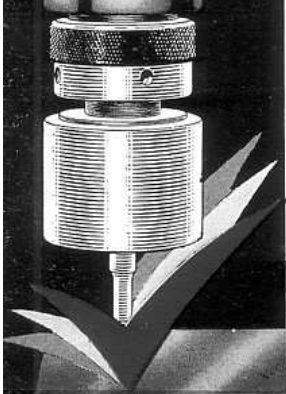
42 Inch or 48 Inch Diameter

PRATT & WHITNEY is the only machine tool builder that makes a Jig Borer with a built-in rotary table. Combining all of the advantages of the Jig Borer with *all* of the features of the P&W motor driven Rotary Table in one specialized machine, precisely constructed to P&W standards, offers attractive advantages to tool shops and plants having unusual amounts of circular indexing and polar co-ordinate work to perform on large jigs, fixtures, dies, etc.

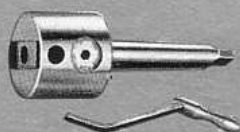
The No. 3B Jig Borer can be furnished with either a 42 inch or a 48 inch diameter table, with T-slots positioned either parallel or radial. It is often desirable to order the machine equipped with a raising block installed between column and bed to gain additional vertical capacity over the working surface of the table.

Detailed specifications sent promptly on request.

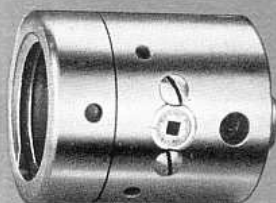
ADDITIONAL FOR P & W



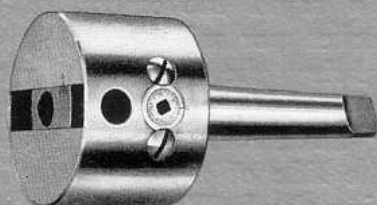
3/8" CAPACITY



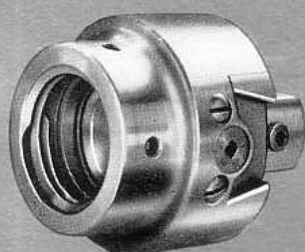
3/4" CAPACITY



3/4" CAPACITY



1" CAPACITY



ADJUSTABLE BORING HEADS

DRILL CHUCK



CENTER PUNCH



SPOTTING TOOL



BORING HEADS

Conventional Adjustable Type

3/8" capacity—1/4" maximum offset, graduated in .001", No. 2 Morse Taper Shank, weight 2 pounds. For use with No. 1 and No. 4 sets of precision boring tools.

3/4" capacity—1/2" maximum offset, graduated in .001", furnished with threaded adapter to fit spindle nose of machine, weight 9 pounds. For use with No. 2 and No. 5 sets of precision boring tools.

*3/4" capacity—1" maximum offset, graduated in .001", furnished with threaded adapter to fit spindle nose of machine, weight 11 pounds. For use with No. 2 and No. 5 sets of precision boring tools.

3/4" capacity—1 1/4" maximum offset, graduated in .001", No. 4 Morse Taper Shank, weight 9 pounds. For use with No. 2 and No. 5 sets of precision boring tools.

*1" capacity—2 1/2" maximum offset, graduated in .001", furnished with threaded adapter to fit spindle nose of machine, weight 15 pounds. For use with No. 3 and No. 6 sets of precision boring tools.

*Note:—The 3/4" and 1" capacity boring heads arranged with threaded adapters to fit the spindle nose are recommended for best possible boring results.

Precision Universal Type (not illustrated)

3/4" capacity—3/4" maximum offset, graduated in .001", No. 4 Morse Taper Shank, weight 9 pounds. For use with No. 2 and No. 5 sets of precision boring tools. Includes complete accessories used with this boring head as listed in Precision Universal Tool Co. literature.

DRILL CHUCKS

0 to 3/8" capacity with No. 2 Morse Taper Shank.

1/8" to 5/8" capacity with No. 2 Morse Taper Shank.

1/8" to 3/4" capacity with No. 4 Morse Taper Shank.

CENTER PUNCH OR SCRIBING TOOL

Hardened, precision ground, fits directly in spindle nose.

SPOTTING TOOLS

5/16" diameter with No. 2 Morse Taper Shank.

7/16" diameter with No. 1 Morse Taper Shank.

5/8" diameter with No. 2 Morse Taper Shank.

7/8" diameter with No. 3 Morse Taper Shank.

1" diameter with No. 4 Morse Taper Shank.

USED WITH MACHINE NO.

1 1/2 B 2A 3B

1 1/2 B

2A 3B

2A 3B

2A 3B

2A 3B

1 1/2 B 2A 3B

1 1/2 B 2A 3B

1 1/2 B 2A 3B

1 1/2 B 2A 3B

1 1/2 B 2A 3B

1 1/2 B 2A 3B

1 1/2 B 2A 3B

EQUIPMENT

JIG BORERS

This additional equipment is carried in stock and is furnished to order only

USED WITH
MACHINE NO

$1\frac{1}{2}$ B	2A	3B
$1\frac{1}{2}$ B	2A	3B
	2A	3B
$1\frac{1}{2}$ B	2A	3B
$1\frac{1}{2}$ B	2A	3B
	2A	3B
	2A	3B
	2A	3B
$1\frac{1}{2}$ B	2A	3B
	2A	3B
$1\frac{1}{2}$ B	2A	3B
$1\frac{1}{2}$ B	2A	3B

BORING TOOLS Either H. S. S. or Carbide Tipped.

No. 1 Set—Made of special analysis high grade high speed steel for use with $\frac{3}{8}$ " capacity boring head. Set includes one each $\frac{3}{16}$ ", $\frac{5}{16}$ ", $\frac{7}{16}$ " and $\frac{9}{16}$ " precision boring tools all with $\frac{3}{8}$ " round shanks, including hard wood block.

No. 2 Set—Made of special analysis high grade high speed steel for use with $\frac{3}{4}$ " capacity boring heads. Set includes one each $\frac{1}{4}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", 1" and $1\frac{1}{4}$ " precision boring tools all with $\frac{3}{4}$ " round shanks, including hard wood block.

No. 3 Set—Made of special analysis high grade high speed steel for use with 1" capacity boring head. Set includes one each 1¼", 1½", 1¾" and 2" precision boring tools all with 1" round shanks, including hard wood block.

No. 4 Set—Carbide Tipped for use with $\frac{3}{8}$ " capacity boring head. Set includes one each $\frac{3}{16}$ ", $\frac{5}{16}$ ", $\frac{7}{16}$ " and $\frac{9}{16}$ " precision boring tools all with $\frac{3}{8}$ " round shanks, including hard wood block.

No. 5 Set—Carbide Tipped for use with $\frac{3}{4}$ " capacity boring head. Set includes one each $\frac{1}{4}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", 1" and 1 $\frac{1}{4}$ " precision boring tools all with $\frac{3}{4}$ " round shank, including hard wood block.

No. 6 Set—Carbide Tipped for use with 1" capacity boring head. Set includes one each 1¼", 1½", 1¾" and 2" precision boring tools all with 1" round shank, including hard wood block.

Note:—The high speed steel precision boring tools and the Carbide Tipped precision boring tools have the same general dimensions in the following set comparisons:

No. 1 with No. 4. No. 2 with No. 5 No. 3 with No. 6.

BORING BARS

For use direct in the machine spindle collet.

$\frac{7}{8}$ " diameter, 10" long, No. 4 Morse Taper Shank.

1" diameter, 11" long, No. 4 Morse Taper Shank.

1 1/4" diameter, 12" long, No. 4 Morse Taper Shank.

PRECISION END MILL REAMERS

No. 1 Set—Consists of 7 reamers, one each $\frac{1}{8}$ ", $\frac{3}{16}$ ", $\frac{1}{4}$ ", $\frac{5}{16}$ ", $\frac{3}{8}$ ", $\frac{7}{16}$ " and $\frac{1}{2}$ " high speed steel, including mahogany case.

No. 2 Set—Consists of 17 reamers, one each $\frac{1}{8}$ ", $\frac{3}{16}$ ", $\frac{1}{4}$ ", $\frac{5}{16}$ ", $\frac{3}{8}$ ", $\frac{7}{16}$ ", $\frac{1}{2}$ ", $\frac{5}{8}$ ", $\frac{3}{4}$ ", $\frac{7}{8}$ ", 1", $1\frac{1}{8}$ ", $1\frac{1}{4}$ ", $1\frac{3}{8}$ ", $1\frac{1}{2}$ ", $1\frac{3}{4}$ " and 2" high speed steel, including mahogany case.

No. 3 Set—Consists of 12 reamers, one each $\frac{1}{8}$ ", $\frac{3}{16}$ ", $\frac{1}{4}$ ", $\frac{5}{16}$ ", $\frac{3}{8}$ ", $\frac{7}{16}$ ", $\frac{1}{2}$ ", $\frac{5}{8}$ ", $\frac{3}{4}$ ", $\frac{7}{8}$ ", 1" and $1\frac{1}{8}$ " high speed steel, including mahogany case.

Other sizes available to order only.

For corresponding taper shanks, see Pratt & Whitney Small Tool Catalog.

ANGULAR CIRCLE INDEXING CALCULATIONS

For use with Rotary Tables.



Contains all the necessary angles in degrees, minutes and nearest second for dividing a circle into any number of equal parts from two to one hundred inclusive. Correct chordal distances also are given in each case, accurate to six places. Printed on heavy stock, cellophane laminated to stand up under continual use.



No. 1 or No. 4 Set



**No. 2 or
No. 5 Set**

BORING TOOLS



No. 3 or No. 6 Set

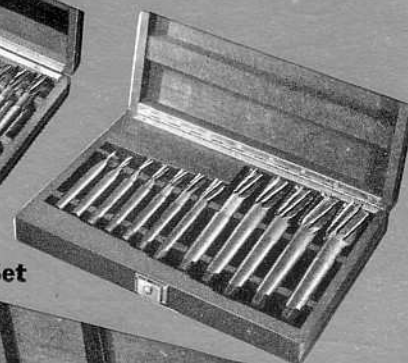
**No. 1, No. 2
and No. 3
Sets are
High Speed
Steel.
No. 4, No. 5
and No. 6
sets are
Carbide
Tipped.**



BORING BAR

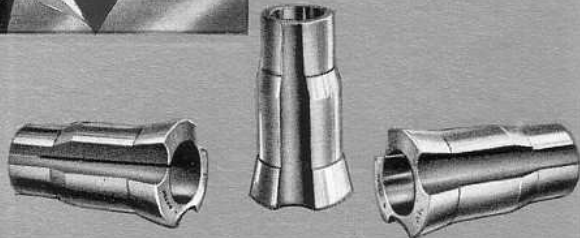
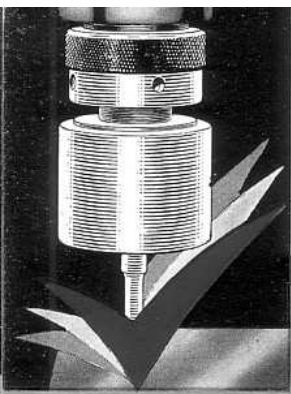


No. 1 Set

**No. 3 Set****No. 2 Set**

PRECISION END MILL REAMERS

ADDITIONAL FOR P & W



DOUBLE TAPER COLLETS



No. 1 Set

No. 2 Set

STUB GAGES

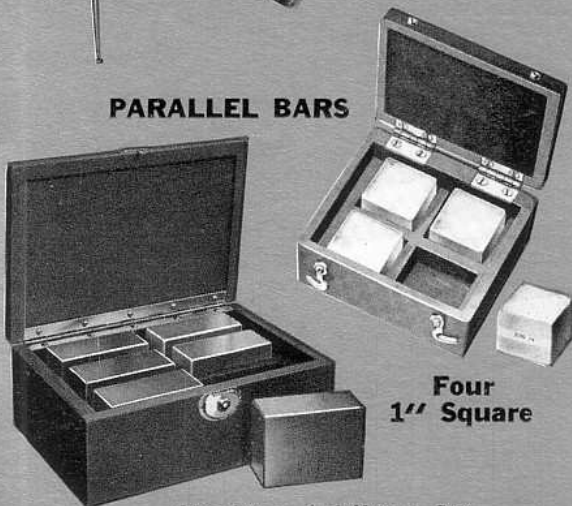


**WORK
LOCATING
INDICATOR**



**PROVING
BAR**

PARALLEL BARS



**Four
1" Square**

Six 1" x 1-1/2" x 3"

COLLETS

Taper Collets—Nos. 1 and 2 Morse. Nos. 5, 6 and 7 B&S.

Taper Collets—Nos. 1, 2, 3 and 4 Morse. Nos. 5, 7, 9 and 10 B&S.

Round Collets— $\frac{3}{32}$ ", $\frac{1}{8}$ ", $\frac{5}{32}$ ", $\frac{3}{16}$ ", $\frac{7}{32}$ ", $\frac{1}{4}$ ", $\frac{9}{32}$ ", $\frac{5}{16}$ ", $\frac{3}{8}$ ", $\frac{7}{16}$ ", $\frac{1}{2}$ ", $\frac{9}{16}$ ", $\frac{5}{8}$ ", $\frac{11}{16}$ " and $\frac{3}{4}$ ". Other sizes between $\frac{3}{8}$ " and $\frac{3}{4}$ " and all millimeter sizes between 2 m/m and 18 m/m to order only.

Round Collets— $\frac{3}{8}$ ", $\frac{7}{16}$ ", $\frac{1}{2}$ ", $\frac{9}{16}$ ", $\frac{5}{8}$ ", $\frac{11}{16}$ ", $\frac{3}{4}$ ", $\frac{13}{16}$ ", $\frac{7}{8}$ ", $\frac{15}{16}$ ", 1", $1\frac{1}{16}$ " and $1\frac{1}{8}$ ". Other sizes between $\frac{3}{8}$ " and $1\frac{1}{8}$ " and all millimeter sizes between 9 m/m and 32 m/m to order only.

All above collets have double taper on the outside and fit the regular machine spindle.

STUB GAGES

No. 1 Set—Consists of 7 gages, one each $\frac{1}{8}$ ", $\frac{3}{16}$ ", $\frac{1}{4}$ ", $\frac{5}{16}$ ", $\frac{3}{8}$ ", $\frac{7}{16}$ " and $\frac{1}{2}$ ", including mahogany case.

No. 2 Set—Consists of 17 gages, one each $\frac{1}{8}$ ", $\frac{3}{16}$ ", $\frac{1}{4}$ ", $\frac{5}{16}$ ", $\frac{3}{8}$ ", $\frac{7}{16}$ ", $\frac{1}{2}$ ", $\frac{5}{8}$ ", $\frac{3}{4}$ ", $\frac{7}{8}$ ", 1", $1\frac{1}{8}$ ", $1\frac{1}{4}$ ", $1\frac{3}{8}$ ", $1\frac{1}{2}$ ", $1\frac{3}{4}$ " and 2", including mahogany case.

Other sizes available to order only.

SPINDLE PROVING BAR

Hardened and precision ground. Fits directly in the spindle nose.

WORK LOCATING INDICATOR (Horizontal Type)

For locating work from a finished hole or a finished boss diameter, for checking parallelism, etc. Also includes a proving bar for locating from a finished edge. Proving bar is $\frac{1}{2}$ " for No. 1 Machine; $\frac{3}{4}$ " for Nos. 2A and 3B Machines. Complete with mahogany case.

CROSS LINE FINDER (not illustrated)

For accurately locating the machine spindle over a cross center line. Furnished with a No. 2 Morse Taper Shank.

PARALLEL BARS

Six hardened and precision ground steel bars 1" x $1\frac{1}{2}$ " x 3" with mahogany case.

Four hardened and precision ground standard blocks, 1" square, with mahogany case.

USED WITH MACHINE NO.

$1\frac{1}{2}$ B	2A	3B
$1\frac{1}{2}$ B	2A	3B
$1\frac{1}{2}$ B	2A	3B
$1\frac{1}{2}$ B	2A	3B
$1\frac{1}{2}$ B	2A	3B
$1\frac{1}{2}$ B	2A	3B
$1\frac{1}{2}$ B	2A	3B
$1\frac{1}{2}$ B	2A	3B
$1\frac{1}{2}$ B	2A	3B
$1\frac{1}{2}$ B	2A	3B

EQUIPMENT

JIG BORERS

This additional equipment is carried in stock and is furnished to order only

USED WITH MACHINE NO.

1 1/2 B	2A	3B
1 1/2 B	2A	3B
1 1/2 B	2A	3B
1 1/2 B	2A	3B
1 1/2 B	2A	3B
1 1/2 B	2A	3B
1 1/2 B	2A	3B
1 1/2 B	2A	3B
1 1/2 B	2A	3B
1 1/2 B	2A	3B

PRECISION ANGLE IRON

Working surface 6" high by 12" long, and 4 1/2" wide, accurately scraped, arranged with three vertical 1/16" T-slots, and key for aligning with Table T-slot.

Working surface 8" high by 16" long, and 6" wide, accurately scraped, arranged with three vertical 1/16" T-slots, and key for aligning with Table T-slot. (For No. 2430 machine).

Working surface 9" high by 24" long, and 8" wide, accurately scraped, arranged with four vertical 1/16" T-slots, and key for aligning with Table T-slot. (For No. 3644 machine).

Working surface 9" high by 24" long, and 8" wide, accurately scraped, arranged with four vertical 11/16" T-slots, and key for aligning with Table T-slot.

*END MEASURES

English—1", 2", 3", 6" and 12".

Metric—20 m/m, 40 m/m, 60 m/m, 100 m/m, 200 m/m and 300 m/m.

*INSIDE MICROMETERS

English—1".

Metric—25 m/m.

*Complete sets of end measures and inside micrometers are furnished as regular equipment with each machine. Additional end measures and inside micrometers are carried in stock, available to order only.

BUILT-IN SCALES (not illustrated)

One on carriage slide and one on table slide for approximate setting, graduated in English or Metric.

CLAMPS, T-BOLTS AND STEP BLOCKS (Built-up Type)

Eight 3/8" connectors, four 3/8" x 3" T-bolts, four 3/8" x 4" T-bolts, four 1 1/2" extensions, four 2 1/2" extensions, four 4" extensions, four 6" extensions, four clamps and four wood step blocks. Furnished in one wooden box.

Twelve 1/2" connectors, six 1/2" x 3" T-bolts, six 1/2" x 4" T-bolts, six 2" extensions, six 4" extensions, six 6" extensions, six 8" extensions, six 9/16" x 4" clamps and six wood step blocks. Furnished in one wooden box.

Twelve 5/8" connectors, six 5/8" x 4" T-bolts, six 5/8" x 8" T-bolts, six 5/8" x 12" T-bolts, six 2" extensions, six 4" extensions, six 6" extensions, six 8" extensions, six 1 1/16" x 4" clamps and six wood step blocks. Furnished in one wooden box.

ACCESSORY TOOL CABINET

Steel cabinet with double swing locking doors, painted machine gray, with shelves arranged to hold all the above listed accessories.

Approximately 38" wide, 72" high and 18" deep.

ADAPTER PLATES FOR UNIVERSAL DIVIDING HEAD AND TAILSTOCK (not illustrated).

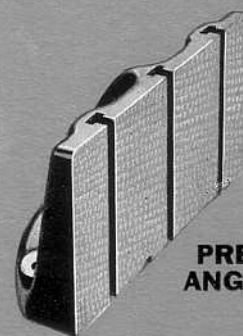
Permit using the Indexing Head and Adjustable Tailstock which are furnished as additional equipment for the P&W No. 3 Model C Universal Bench Miller.

POWER TRAVERSE UNITS

Provide power rapid movement for table and carriage of No. 2A (3644) Jig Borer. Illustrated and described on Page 19.

ROTARY TABLES

Available in several types and sizes. See pages 16 through 19 for illustrations, descriptions and specifications.



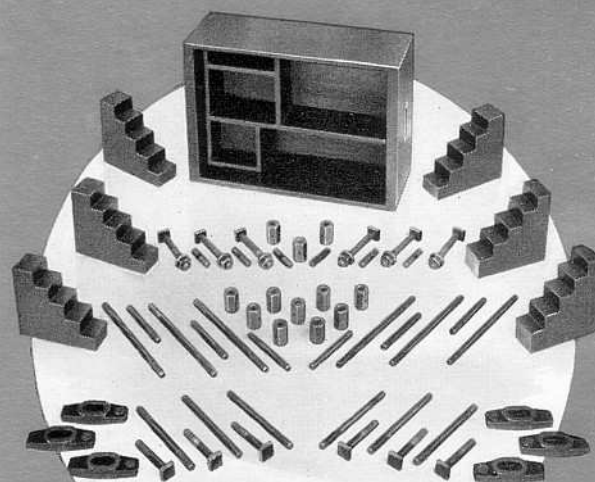
PRECISION ANGLE IRON



END MEASURES



INSIDE MICROMETER

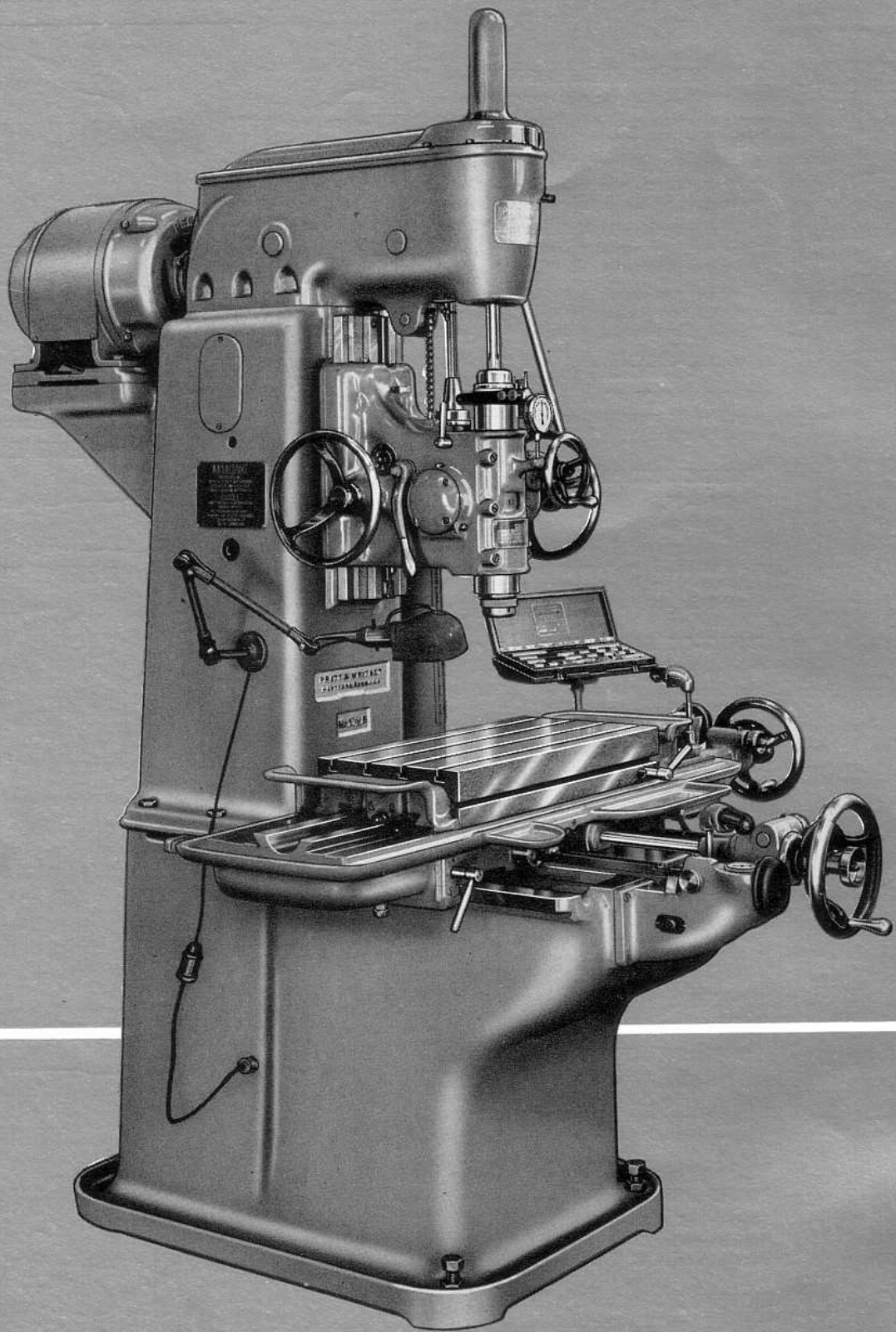


CLAMPS, T-BOLTS & STEP BLOCKS



ACCESSORY TOOL CABINET

PRATT & WHITNEY



24

FOR THE FINEST OF SMALL

No. 1 $\frac{1}{2}$ B JIG BORER

SPECIFICATIONS

RANGE:

Table working surface	12" x 24"
Table travel, longitudinal	18"
Table travel, transverse	12"
Table top to spindle end, maximum	16"
Table top to spindle end, minimum	3"
12" Rotary Table, top to spindle end, max.	11 $\frac{1}{2}$ "
12" Rotary Table, top to spindle end, min.	0
10" Tilting Rotary Table, top to spindle end, max.	9 $\frac{1}{2}$ "
10" Tilting Rotary Table, top to spindle end, min.	0
Head travel on column	7 $\frac{1}{2}$ "
Spindle quill travel in head	5 $\frac{1}{2}$ "
Spindle quill, graduated in 16ths	
Spindle center to column way guide	10"
Spindle center to column neck below ways	13 $\frac{1}{2}$ "
Table top to bottom of column ways	10"
Floor to top of table	36 $\frac{1}{2}$ "
Quill, hardened, diameter	3"
Spindle, range of collets, Round	$\frac{3}{32}$ " to $\frac{3}{4}$ "
Morse	No. 1 and 2
Brown & Sharpe	No. 5, 6, 7
Number of $\frac{7}{16}$ " T-slots, spaced 3" center to center	4

SPEEDS AND FEEDS:

Spindle speeds (8), (with D.C. or 60 cycle A.C. motors) R.P.M.	*130 to 1800
Spindle power feeds, both up and down (3), per revolution of spindle	.001"—.002"—.005"
Spindle is mounted on super-precision ball bearings, permanently lubricated and sealed	
Spindle quill is hardened, precision ground and draw-polished	

FLOOR SPACE:

Width	65"
Depth	77"
Height—from floor to top of speed box cover	81"
Height—from floor to top of spindle drive shaft guard	89"

WEIGHTS:

Machine with regular equipment, approximate net lbs.	3965
Crating material, domestic, approximate lbs.	1000
Boxing material, foreign, approximate lbs.	1770
Box, approximate cubic feet	250

REGULAR EQUIPMENT

English:

Includes the machine with choice of either 50 or 60 cycle A.C. or D.C. Standard N.E.M.A. Frame $\frac{3}{4}$ H.P. motor (*) with all necessary electrical wiring and controls; two built-in locating devices, one on carriage and one on table, each with a built-in dial indicator graduated in .0001"; set of measuring instruments consisting of two 1" inside micrometers, and a set of end measures, two each 1", 2", 3", 6" and one 12", all in a mahogany box which fits the adjustable tray on the right side of the machine carriage; one depth measuring device on the quill reading to .001", and arranged with a positive screw stop; one each $\frac{1}{2}$ " straight No. 1 and 2 Morse taper collets; one oil can; one adjustable light for spindle; individual lights on carriage and table locating devices; one set of wrenches; one can of oil for spindle speed gear boxes and one for carriage and table ways; and one can of paint.

Metric:

Includes the machine with choice of either 50 or 60 cycle A.C. or D.C. Standard N.E.M.A. Frame $\frac{3}{4}$ H.P., motor (*) with all necessary electrical wiring and controls; two built-in locating devices, one on carriage and one on table, each with a built-in dial indicator graduated in 1/500 m/m; set of measuring instruments consisting of two 25 m/m inside micrometers and a set of end measures, two each 20, 40, 60, 100, 200 and one 300 m/m, all in a mahogany box which fits the adjustable tray on the right side of the machine carriage; one depth measuring device on the quill reading to 1/100 m/m, and arranged with a positive screw stop; one straight collet, choice of size between 2 m/m and 17 $\frac{1}{2}$ m/m; one each No. 1 and 2 Morse taper collets; one oil can; one adjustable light for spindle; individual lights on carriage and table locating devices; one set of wrenches; one can of oil for spindle speed gear boxes and one for carriage and table ways; and one can of paint.

NOTES:

*A.C. 50 cycle motors have four speeds—500-750-1000-1500 R.P.M.

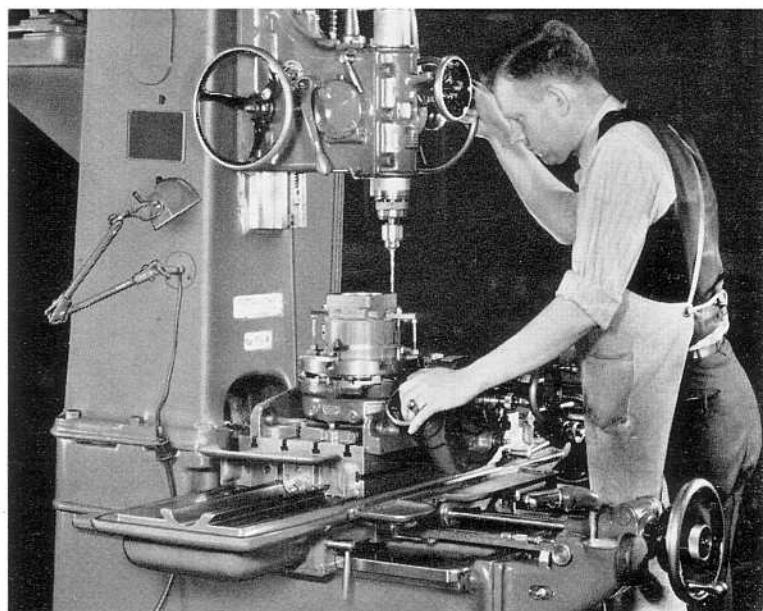
A.C. 60 cycle motors have four speeds—600-900-1200-1800 R.P.M.

D.C. motors have variable speeds from 600 to 1800 R.P.M.

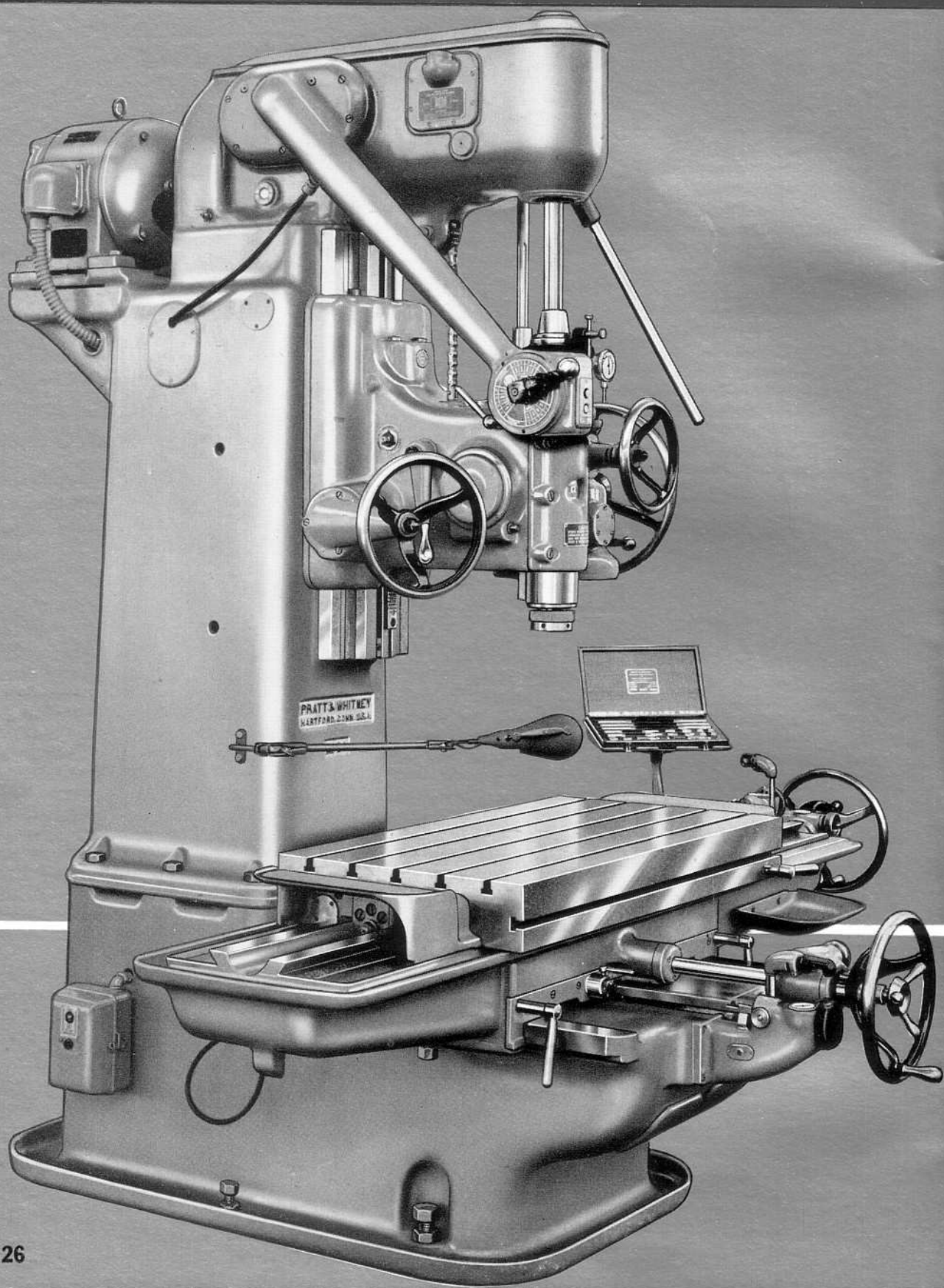
When the machine is arranged with 50 cycle current the spindle speeds are from 108 to 1500 R.P.M.

A frequency changer will be required with A.C. 25 cycle current (to order only). This arrangement gives 50 or 60 cycle spindle speeds, as ordered.

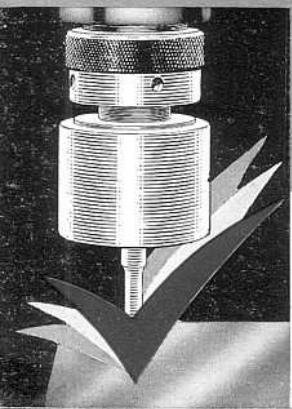
A phase changing transformer will be required with two-phase A.C. current (to order only).



PRATT & WHITNEY



26



FOR HIGH-SPEED LOW-COST

No. 2A JIG BORER

SPECIFICATIONS

RANGE:

	No. 2430	No. 3644
Table working surface	16" x 30"	22" x 44"
Table travel, longitudinal	24"	36"
Table travel, transverse	18"	18"
Table top to spindle end, max.	24"	27 1/2"
Table top to spindle end, min.	2 1/2"	6"
16" Tilting Rotary Table, top to spindle end, max.	15 1/2"	19"
20" Rotary Table, top to spindle end, max.	17"	20 1/2"
24" Rotary Table, top to spindle end, max.	17"	20 1/2"
30" Rotary Table, top to spindle end, max.	not furnished	19 1/2"
Head travel on column	12 1/2"	12 1/2"
Spindle quill travel	9"	9"
Spindle quill graduated in 16ths	17 1/2"	17 1/2"
Spindle center to column way guide	32"	34 1/2"
Floor to top of table	22"	22"
Spindle center to column neck	10"	13 1/2"
Table top to bottom of column ways	4 1/2"	4 1/2"
Quill, hardened, diameter	3/8" to 1 1/8"	
Spindle, range of collets, Round	No. 1, 2, 3, 4	
Morse	No. 5, 7, 9, 10	
Brown & Sharpe		
Number of 9/16" T-slots, spaced 4" center to center	4	5

SPEEDS AND FEEDS:

	No. 2430	No. 3644
Spindle speeds (12), (with D.C. or 60 cycle A.C. motors) R.P.M.	*37 to 1800	*37 to 1800
Spindle is mounted on super-precision ball bearings, permanently lubricated and sealed		
Spindle quill is hardened, precision ground and draw-polished		
Spindle power feeds, both up and down (8), per revolution of spindle	.0005" to .010"	.0005" to .010"

FLOOR SPACE:

Width	80"	104"
Depth, with standard 4-speed motor	93"	93"
Depth, with fan cooled 4-speed motor	97"	97"
Height	98"	104"

WEIGHTS:

Machine with regular equipment, approx. net lbs.	7,800	8,850
Crating material, (two crates) domestic, approx. lbs.	1,750	1,900
Boxing material, foreign, approx. lbs.	2,550	3,550
Two boxes, approx. total cu. ft.	412	475

REGULAR EQUIPMENT

English - No. 2430

Includes the machine with choice of either D.C. or 50 or 60 cycle A.C. Standard N.E.M.A. 1 1/2 H.P. motor (*) with all necessary electrical wiring and controls; two built-in locating devices, one on carriage and one on table, each with a built-in dial indicator graduated in .0001"; set of measuring instruments consisting of two 1" inside micrometers, and a set of end measures, two each 1", 2", 3", 6" and 12", all in a mahogany box, which fits the adjustable tray on the right side of the machine carriage; one depth dial indicator adjustable on quill and arranged with positive screw stop; one 3/4" round collet; one each No. 1, 2, 3 and 4 Morse taper collets; one nickel plated oil can; individual electric lights on carriage and table locating devices; one adjustable light for spindle; set of wrenches; one can of oil for gear boxes and one for carriage and table ways; one can of paint.

English - No. 3644

Same as above except that three 12" end measures are furnished instead of two.

• • •

NOTES:

*When the machine is arranged for 50 cycle current, the spindle speeds are 30 to 1500 R.P.M.

A.C. 50 cycle motors have four speeds 500, 750, 1000 and 1500 R.P.M.

A.C. 60 cycle motors have four speeds 600, 900, 1200 and 1800 R.P.M.

D.C. motors are variable speed from 600 to 1800 R.P.M.

A frequency changer will be required with 25 cycle A.C. (to order only).

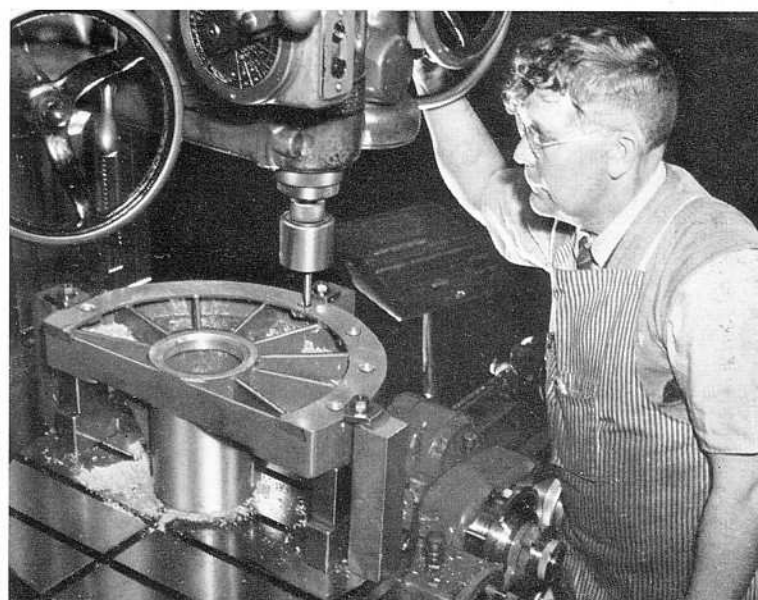
A phase changing transformer will be required with two phase A.C. (to order only).

Metric - No. 2430

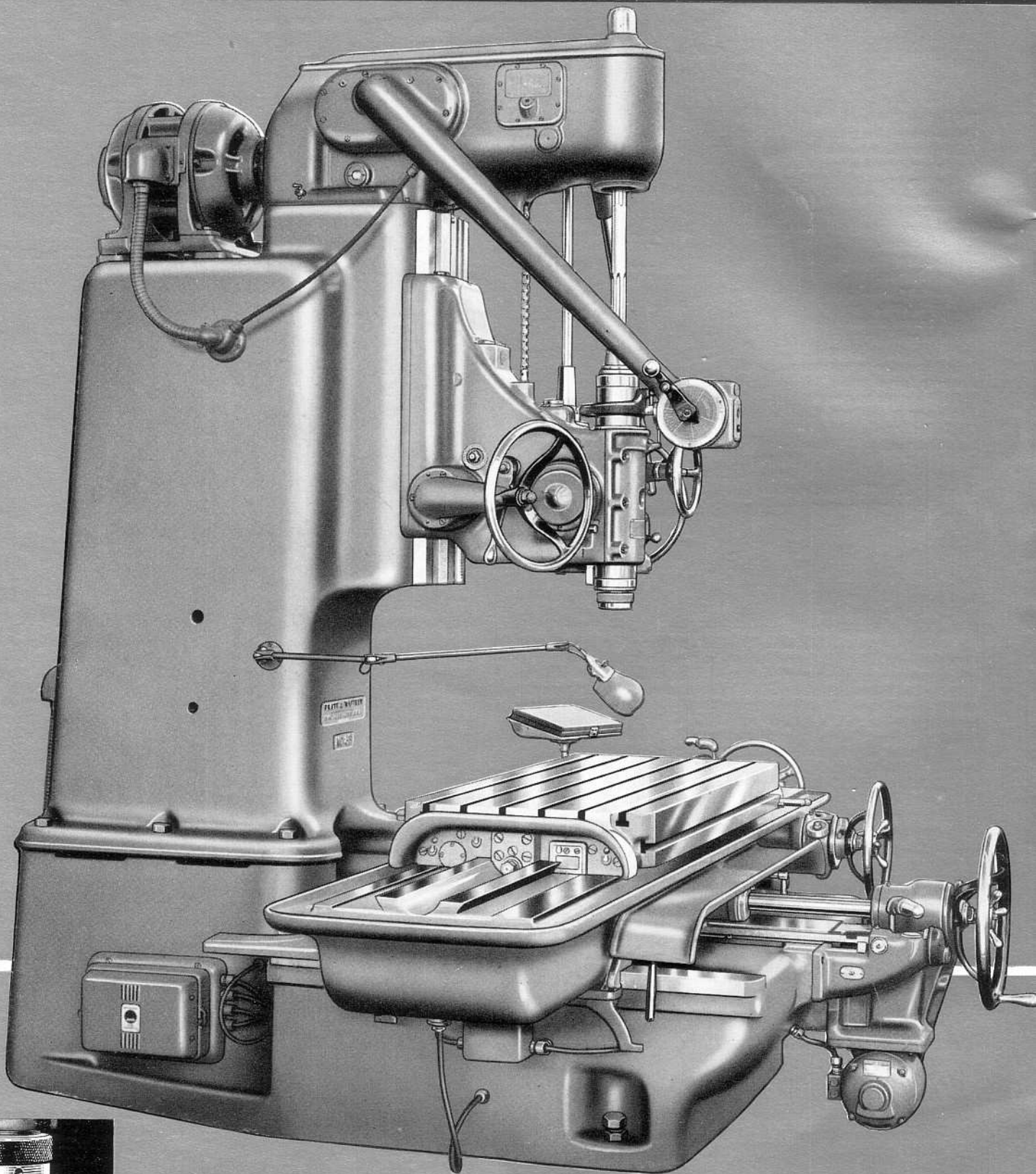
Includes the machine with choice of either D.C. or 50 or 60 cycle A.C. Standard N.E.M.A. 1 1/2 H.P. motor (*) with all necessary electrical wiring and controls; two built-in locating devices, one on carriage and one on table, each with a built-in dial indicator graduated in 1/500 m/m; set of measuring instruments consisting of two 25 m/m inside micrometers, and a set of end measures, two each 20, 40, 60, 100, 200 and 300 m/m, all in a mahogany box, which fits the adjustable tray on the right side of the machine carriage; one depth dial indicator adjustable on quill and arranged with positive screw stop; one round collet to suit customer's requirements; one each No. 1, 2, 3 and 4 Morse taper collets; quill and spindle feed plate metric graduated; one nickel plated oil can; individual electric lights on carriage and table locating devices; one adjustable light for spindle; set of wrenches; one can of oil for gear boxes and one for carriage and table ways; one can of paint.

Metric - No. 3644

Same as above except that three 300 m/m end measures are furnished instead of two.



PRATT & WHITNEY



28

BIG MACHINE FOR LARGE

No. 3B JIG BORER

SPECIFICATIONS

RANGE:

Table working surface	24" x 54"
Table travel, longitudinal	48"
Table travel, transverse	24"
Table top to spindle end, maximum	30"
Table top to spindle end, minimum	6"
16" Tilting Rotary Table top to spindle end, max.	21½"
20" Rotary Table top to spindle end, max.	23"
24" Rotary Table top to spindle end, max.	23"
30" Rotary Table top to spindle end, max.	22"
Head travel on column	15"
Spindle quill travel	9"
Spindle quill graduated in 16ths	
Quill, hardened, diameter	4½"
Spindle, range of collets, Round	⅜" to 1⅛"
Morse	No. 1, 2, 3, 4
Brown & Sharpe	No. 5, 7, 9, 10
Spindle center to guide on column	17½"
Floor to top of table	34"
Spindle center to column neck	30"
Height of column neck from top of table	20"
Number of ⅛" T-slots, spaced ¾" center to center	6

SPEEDS AND FEEDS:

Spindle speeds (12), (with D.C. or 60 cycle A.C. motors) R.P.M.	*37 to 1800
Spindle is mounted on super-precision ball bearings, permanently lubricated and sealed	
Spindle quill is hardened, precision ground and draw-polished	
Spindle power feeds, both up and down (8), per revolution of spindle	.0005" to .010"

FLOOR SPACE:

Width	130"
Depth, with standard 4-speed motor	109"
Depth, with fan-cooled 4-speed motor	113"
Height	115"

WEIGHTS:

Machine with regular equipment, approx. net lbs.	14,900
Crating material, (six crates) domestic, total approx. lbs.	3,000
Boxing material, foreign, approx. lbs.	4,200
Four boxes, approx. total cu. ft.	694

REGULAR EQUIPMENT

English:

Includes the machine with choice of either A.C. or D.C. Standard N.E.M.A. 1½ H.P. motor (*) for spindle with all necessary electrical wiring and controls; one ¾ H.P. motor for slide, one ½ H.P. motor for table, both for rapid power traverse with necessary wiring and controls; pre-loaded precision ball bearing spindle in hardened quill; two built-in locating devices, one on carriage and one on table, each with a built-in dial indicator graduated in .0001"; set of measuring instruments consisting of two 1" inside micrometers, and a set of end measures, two each 1", 2", 3", 6" and four 12", all in a mahogany box, which fits the adjustable tray on the right side of the machine carriage; one depth dial indicator adjustable on quill and arranged with positive screw stop; one ¾" round collet, one each No. 1, 2, 3 and 4 Morse taper collets; one nickel plated oil can; individual electric lights on carriage and table locating devices; one adjustable light for spindle; set of wrenches; one can of oil for gear boxes and one for carriage and table ways; one can of paint.

NOTES:

• • •

*When the machine is arranged for 50 cycle current, the spindle speeds are 30 to 1500 R.P.M.

A.C. 50 cycle motors have four speeds 500, 750, 1000 and 1500 R.P.M.

A.C. 60 cycle motors have four speeds 600, 900, 1200 and 1800 R.P.M.

D.C. motors are variable speed from 600 to 1800 R.P.M.

A frequency changer will be required with 25 cycle A.C. (to order only).

A phase changing transformer will be required with two phase A.C. (to order only).

No. 3B Jig Borer with Built-in 42-inch or 48-inch Rotary Table

The No. 3B Jig Borer equipped with either a 42-inch or 48-inch built-in motor driven rotary table offers many advantages to tool shops and manufacturers having unusual amounts of circular indexing and polar co-ordinate work to do. See page 19. Detailed specifications will be sent promptly on request.

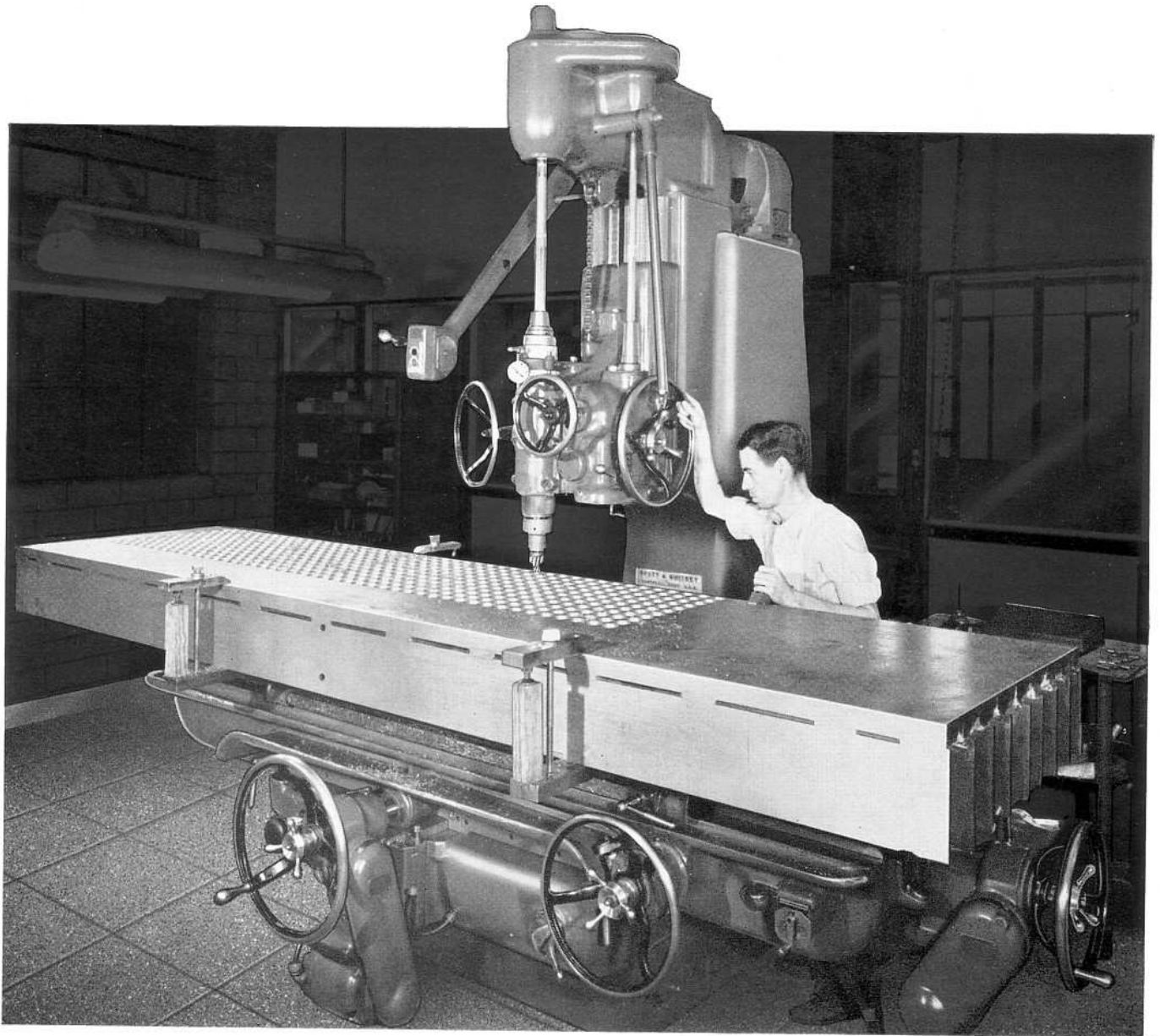
Metric:

Includes the machine with choice of either A.C. or D.C. Standard N.E.M.A. 1½ H.P. motor (*) for spindle with all necessary electrical wiring and controls; one ¾ H.P. motor for slide, one ½ H.P. motor for table, both for rapid power traverse with necessary wiring and controls; pre-loaded precision ball bearing spindle in hardened quill; two built-in locating devices, one on carriage and one on table, each with a built-in dial indicator graduated in 1/500 m/m; set of measuring instruments consisting of two 25 m/m inside micrometers, and a set of end measures, two each 20, 40, 60, 100, 200 and four 300 m/m, all in a mahogany box, which fits the adjustable tray on the right side of the machine carriage; one depth dial indicator adjustable on quill and arranged with positive screw stop; one round collet to suit customer's requirements; one each No. 1, 2, 3 and 4 Morse taper collets; quill and spindle feed plate metric graduated; one nickel plated oil can; individual electric lights on carriage and table locating devices; one adjustable light for spindle; set of wrenches; one can of oil for gear boxes and one for carriage and table ways; one can of paint.

When your precision Jig Boring requirements demand a machine of greater capacity than the No. 3B Machine shown here, investigate the new Pratt & Whitney No. 4E Jig Borer. It has a longitudinal table travel of 60" with a rectangular table working surface of 36" x 72". Detail specifications will be sent promptly on request.

PRATT & WHITNEY IS

**Whether Work Is Simple or Complex,
Small or Large, Linear or Circular,
with Close or Wide Tolerances**



HERE'S a jig boring job that really is BIG. The workpiece — part of a load transmission testing device for studying airport runway surfaces and subgrades — was 136" long, 33" wide and 10" thick. Of webbed (1020) steel construction, it weighed 4000 lbs. The machine is a standard P&W No. 3B Jig Borer with no special equipment other than an outboard support placed under the end of the piece when the holes in the end sections were machined.

Partially completed in the photo, the finished job had 960 precisely spaced holes through the 2" thick plate surface, each with a 2" major diameter 1" deep and a $1\frac{1}{8}$ " diameter pilot hole. Although five roughing cuts and one finish reaming operation were used per hole and the workpiece was reset five times, the operator maintained the excellent average of seven complete holes per hour.

JIG BORER HEADQUARTERS

There Is a P&W JIG BORER of the Right Size to Handle your Work . . . Efficiently, Accurately and More Profitably

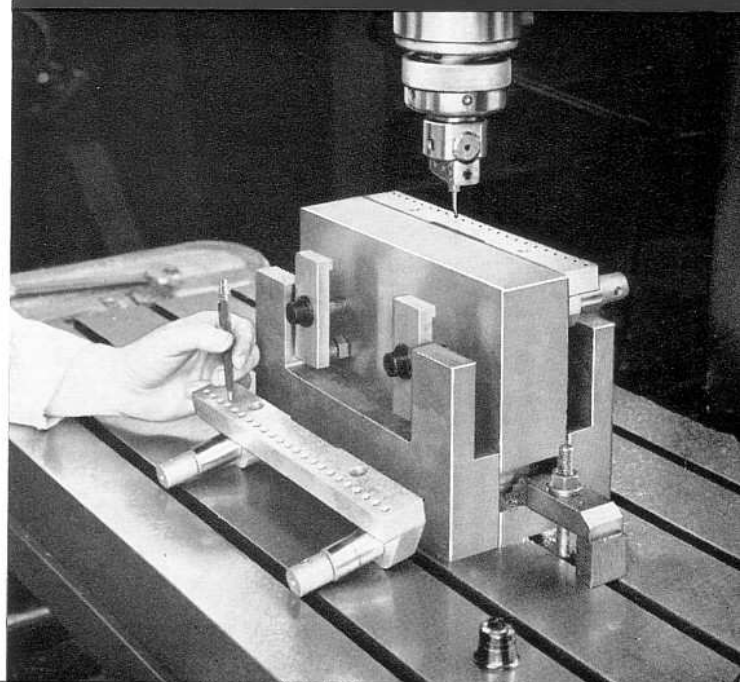
THIS good size circular fixture job emphasizes both the versatility and the accuracy of the P&W Jig Borer. Using a 24" Plain Rotary Table on a No. 2A (3644) Jig Borer, the operator precision-machined 74 accurately-located holes in the 39" diameter steel casting in only 14 hours.

Twenty-six of the holes were drilled $\frac{5}{8}$ " diameter and counter-bored, with an easy spacing tolerance. Twenty-four of the 48 holes at the inner edge of the ring were $\frac{3}{8}$ " diameter drilled, counter-bored $\frac{1}{4}$ ", countersunk and finish bored, and held well within the required close spacing tolerance. The remaining 24 holes were $\frac{13}{32}$ " diameter, and were similarly machined and spaced.



AND then there are the very difficult and sensitive jobs that are occasionally handled so nicely on the P&W Jig Borer. One of these punch and die bars (each about 12" long) required 23 holes .1875" diameter with a tolerance of $+.0000"$, $-.0002"$; the other, 23 holes .3120" diameter with the same tolerance. Center distance between all holes was $.5000" \pm .0002"$; and the permissible accumulated error was $\pm .0005"$.

All holes were finished by single point boring. Heat generated by the machining was effectively drained from the parts into the machine table by the simple expedient of holding them in a simple but substantial cast-iron fixture which acted as a "heat sponge" and dissipator.



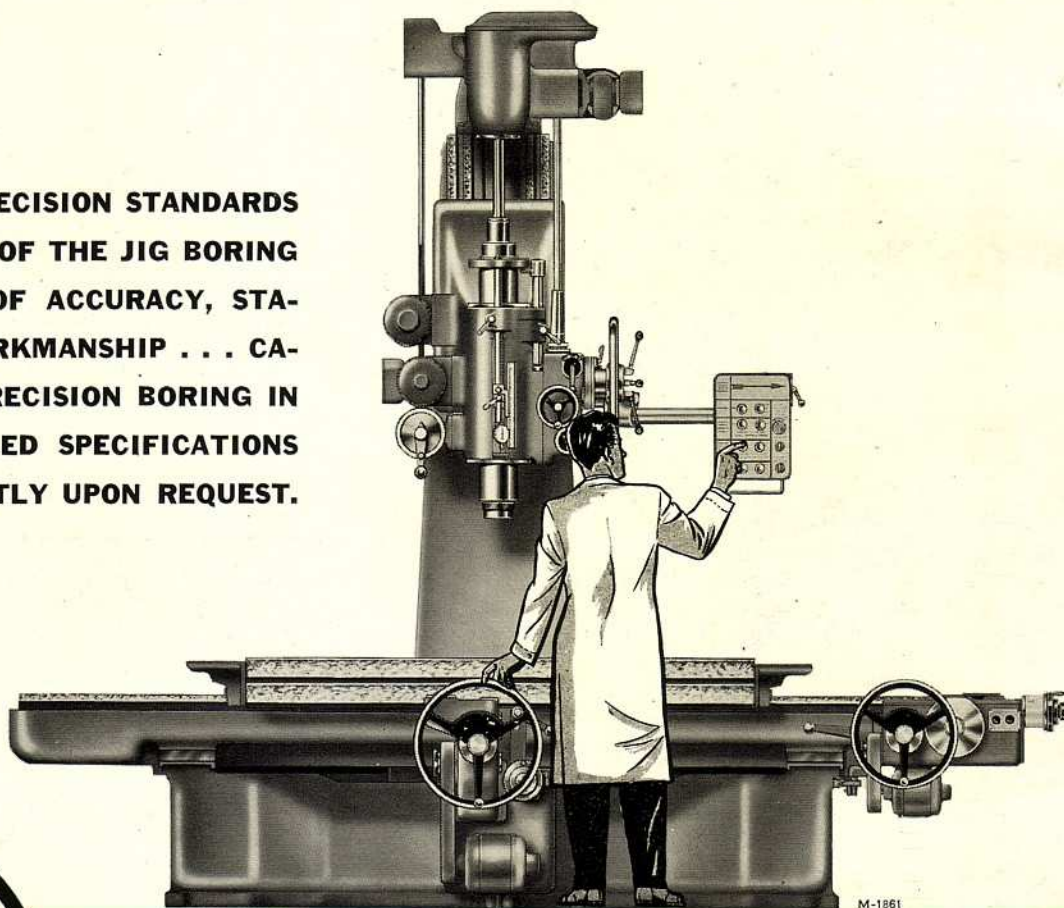
THAN THE RIGHT TOOLS FOR THE JOB

PRATT & WHITNEY LEADS AGAIN

NEW No. 4E **JIG BORER**

36" x 72" RECTANGULAR TABLE

BUILT TO HIGHEST PRECISION STANDARDS
BY THE ORIGINATORS OF THE JIG BORING
MACHINE. 13 TONS OF ACCURACY, STA-
BILITY, AND FINE WORKMANSHIP . . . CA-
PABLE OF "TENTH" PRECISION BORING IN
LARGE WORK. DETAILED SPECIFICATIONS
WILL BE SENT PROMPTLY UPON REQUEST.



PRATT & WHITNEY

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M-1620
M-1695

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