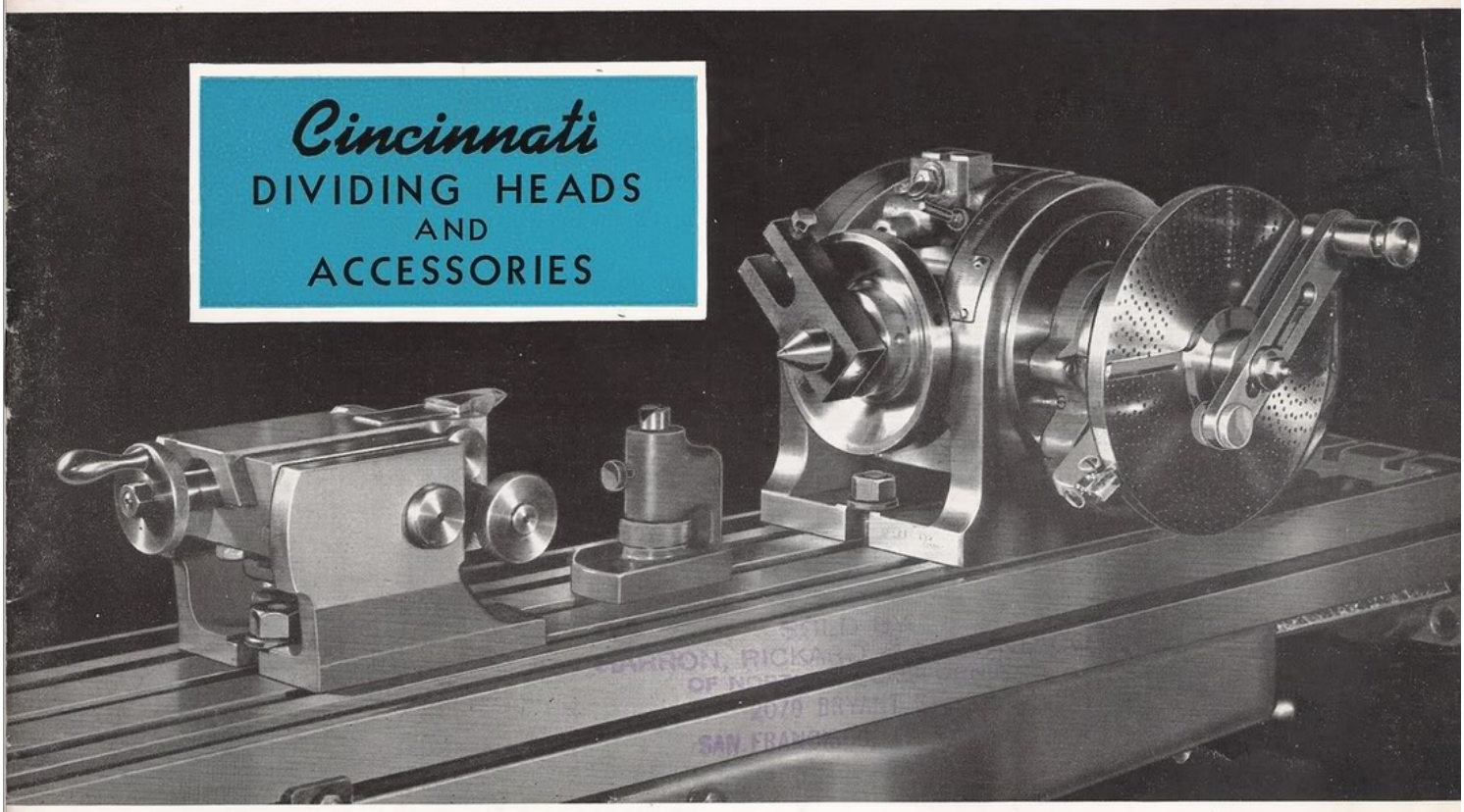
SPECIFICATIONS



CINCINNATI 14″ Dividing Head, Tailstock and Steadyrest

CINCINNATI Dividing Heads, designed primarily for use on CINCINNATI Milling Machines, have several characteristics and features of value in machining a variety of parts such as spur, helical, and bevel gears; worms; various types of cams; cutting dies, etc. Among the more outstanding qualifications for this type of work may be listed:

Indexing accuracy within .0015″ cumulative error on 12″ diameter circle . . . much closer than the requirements for the majority of tool room and manufacturing work.

Spindle block in headstock has 360° clamping surface . . . rigidly maintains setting of spindle during heavy cutting operations.

Front index plate for direct indexing . . . saves time when set-up requires low number divisions.

Side index plate for indexing through 40 to 1 reduction . . . may easily be reversed or replaced with special index plates . . . no change gear compounding required . . . standard plate indexes all numbers up to and including 60; all even numbers and those divisible by 5 from 60 to 120, and many higher numbers up to 1000.

Tailstock has two-point center . . . for large and small work.

Headstock spindle mounted in swivel block which may be set at any angle from 5° below horizontal to 50° beyond vertical; tailstock centers are carried in swivel block which may be swiveled for taper work.

The complete story of CINCINNATI Dividing Heads will be found in the following pages.

THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO, U. S. A.

Publication No. M-1016-2

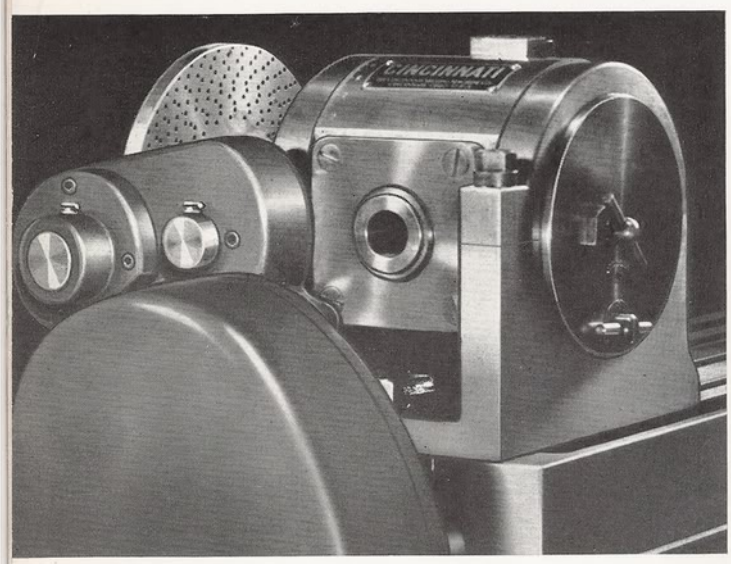


Figure 1

A view from the rear of the 10″ Headstock, set up with the Enclosed Driving Mechanism.

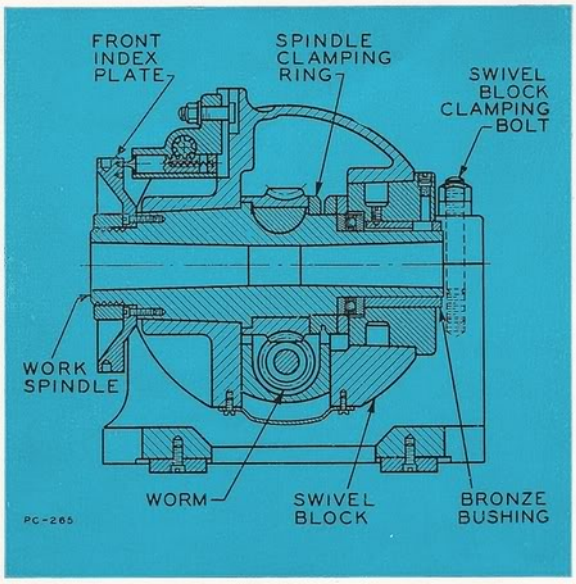


Figure 2
Longitudinal Section Through Headstock

The Headstock

Of first importance in the headstock are the worm and wheel. They are amply large enough for the most severe duty which may be imposed upon them. Notice the under-drive design, Figures 2 and 4, permitting very efficient bath lubrication of the tooth profiles. A convenient method of adjustment, shown in Figure 4, is provided to compensate for wear. The adjustment is made in a plane perpendicular to the axis of the worm wheel, thereby maintaining the original alignment and accuracy.

The well proportioned spindle is rigidly supported, front and rear, nearly its entire length, as shown in Figure 2. During heavy cutting operations, the indexing parts may be relieved of strain by clamping the spindle through the medium of the clamping device shown in Figure 3.

The swivel block is supported on large trunnions of 6½″ diameter in the 10″ head and 8½″ diameter in the 12″ and 14″ heads. Any angle of inclination of the spindle, between 5° below the horizontal and 50° beyond the vertical, may easily be obtained, and firmly held in the desired position, by virtue of the 360° clamping contact. An idea of the effectiveness of this clamping arrangement may be gained by considering the test loads which each head must pass. The 10″ Dividing Head must support, without slipping, a load of 800 pounds; and the 12″ and 14″ heads, 1200 pounds; at a distance of 22″ from the center of the swivel. Notice, also, that this clamp design permits complete protection of the swivel bearings from dust and grit.

The Tailstock

This unit, Figure 5, consists of three main elements: the body, a horizontal sliding bar, and a vertical sliding bar integral with the centers. Both bars are of dovetail shape to permit the most effective clamping effort and after-clamping alignment, similar to the CINCINNATI rectangular overarm construction. The centerpoint bar may be raised or lowered by means of a rack and pinion, and in addition, may be swiveled 10° below or above the horizontal for taper work. This bar has two centers, one for light and one for heavy work, and is easily reversed to bring either into working position. Both the vertical and angular adjustments are clamped independently, thus permitting very accurate adjustments.

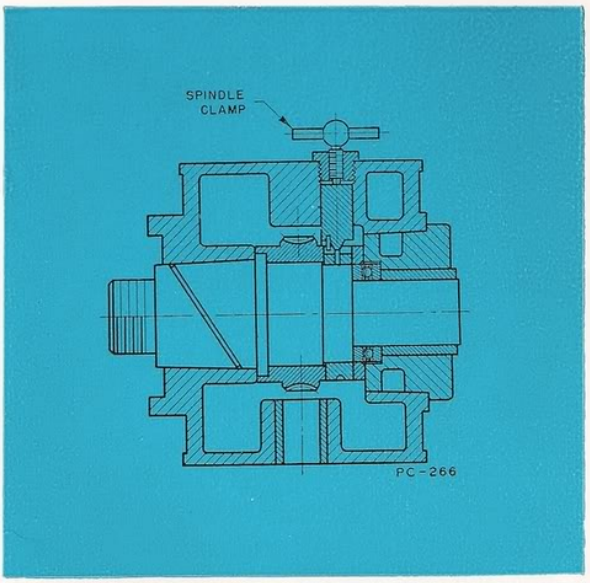


Figure 3
Longitudinal Section Showing Headstock Spindle Clamp

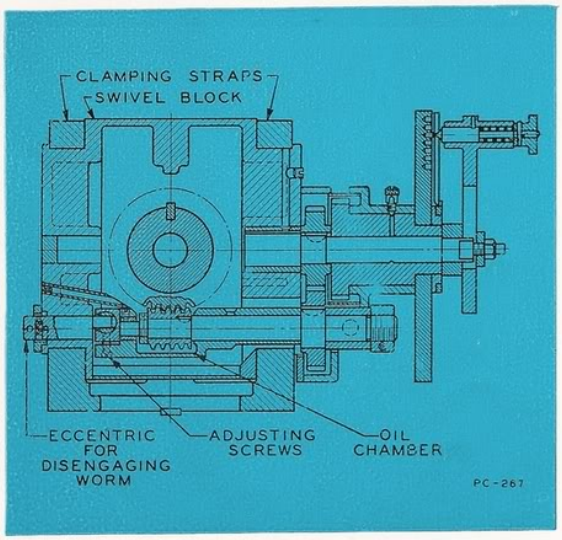


Figure 4
Section Through Headstock Driving Elements

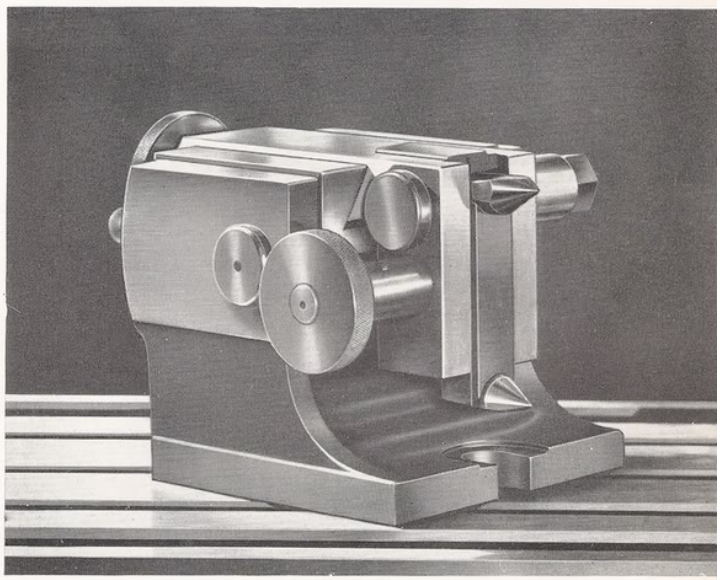


Figure 5
Front View of the Tailstock, showing the Two-point Adjustable Center and Center Adjusting Knob.

Indexing ... The Methods Employed and Divisions Obtainable

Indexing is accomplished either through the 40 to 1 reduction from the crank on the side of the head, Figure 4, or direct with the aid of the plate in front. Of course, a much greater number of divisions are available when indexing through the worm and wheel reduction.

The plate on the side of the head is drilled with 22 circles of concentrically spaced holes, 11 on each side. It may be reversed, presenting either side to the index pin. It is always on the attachment, and therefore can not be lost or damaged by careless handling. The divisions obtainable are shown in the table.

If the job requires only a low number of divisions, namely: 2, 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24, 30, or 36; indexing can be accomplished direct. The worm is disengaged by turning an eccentric stud through half a turn, Figure 4, converting the Dividing Head into plain index centers. Divisions are then obtained by turning the spindle by hand, and engaging the direct index pin in the front plate. This feature is a time saver on a great number of jobs.

Equal-Angle Divisions

In addition to the equal-division spacing listed in the table below, divisions may be obtained in intervals of equal angles by merely transforming one to the other. The 54-hole circle is the most convenient for angular divisions, since each space in this circle of holes is equivalent to 10 minutes.

The Sector

A sector on the crank side of the index plate eliminates the need of counting the number of holes, over which the index crank passes, each time the work is indexed. It follows that this device speeds up the indexing operation, and eliminates the possibility of spoiling work because of unevenly spaced cuts.

In the illustration, the sector is set for twelve holes (spaces). By withdrawing the index pin from the hole next to the left-hand arm of the sector, and relocating it in the hole next to the right-hand arm, the work will have rotated 1/220 of a revolution. Then by merely swiveling the sector as a unit until the left-hand arm again touches the index pin, the work may again be indexed exactly the same amount with no further counting of the number of holes.

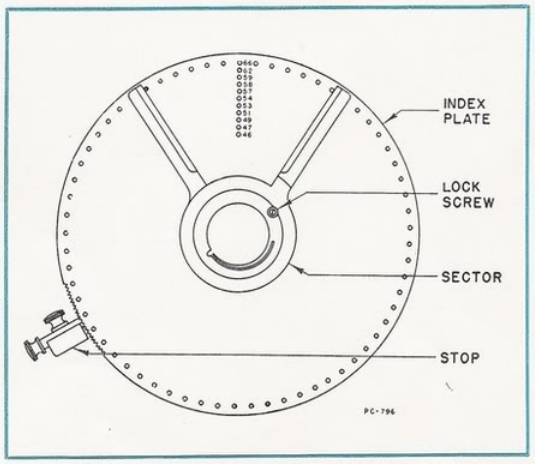


Figure 6
Dividing Head sector and index plate stop. The stop is engaged with the notches in the plate as shown, when the operation does not require the driving mechanism.

Test After Test

To give you a better understanding of the accuracy you can obtain with CINCINNATI Dividing Heads, a few tests are shown. These close limits of accuracy are maintained because of special worm and worm wheel generating machines and special tools which were developed solely for the production of the Dividing Head parts.

Of especial importance is the indexing test illustrated in Figure 9. The disc contains an accurately graduated silver ring. By means of a microscope with micrometer adjustment, the indexing errors can be read to within one-fortieth thousandth (.000025″) of an inch. Each CINCINNATI Dividing Head receives this test. The accumulated error, in indexing from one hole to the next through a complete circle, must be within .0015″ on a 12″ diameter.

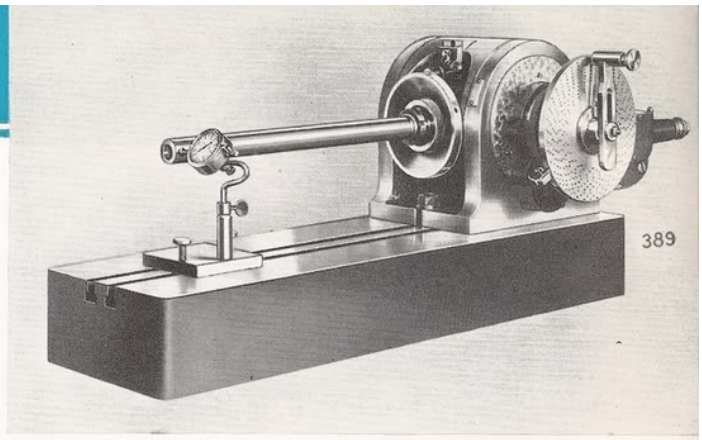


Figure 7
Alignment Test. Only .001″ misalignment with the table T-slot is allowed at the end of the 18″ test bar.

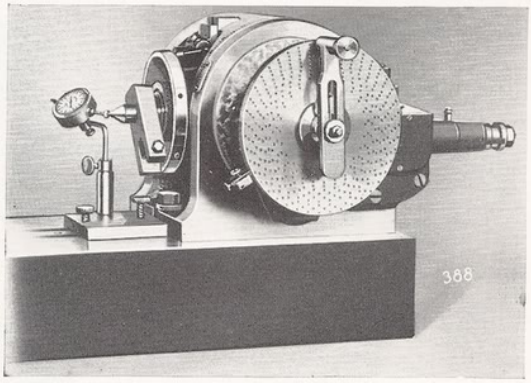


Figure 8
Accuracy of the Spindle Bore. The total error on the center point as the spindle is revolved is not permitted to exceed .00025″,—only 1/10 the thickness of a human hair.

TABLE OF DIVISIONS OBTAINED WITH STANDARD INDEX PLATE

This plate is reversible; drilled on both sides with holes as follows: First side—**24, 25, 28, 30, 34, 37, 38, 39, 41, 42, 43.** Second side—**46, 47, 49, 51, 53, 54, 57, 58, 59, 62, 66.**

It indexes all numbers up to and including 60, all even numbers and those divisible by 5 up to 120, and many beyond those shown in the table.

No. of Divisions	Circle	Turns	Holes	No. of Divisions	Circle	Turns	Holes	No. of Divisions	Circle	Holes	No. of Divisions	Circle	Holes	No. of Divisions	Circle	Holes	No. of Divisions	Circle	Holes	No. of Divisions	Circle	Holes	No. of Divisions	Circle	Holes
2	any	20	....	**29**	58	1	22	**56**	28	20	**96**	24	10	**152**	38	10	**224**	28	5	**340**	34	4	**510**	51	4
3	24	13	8	**30**	24	1	8	**57**	57	40	**98**	49	20	**155**	62	16	**228**	57	10	**344**	43	5	**520**	39	3
4	any	10	....	**31**	62	1	18	**58**	58	40	**100**	25	10	**156**	39	10	**230**	46	8	**360**	54	6	**528**	66	5
5	any	8	....	**32**	28	1	7	**59**	59	40	**102**	51	20	**160**	28	7	**232**	58	10	**368**	46	5	**530**	53	4
6	24	6	16	**33**	66	1	14	**60**	42	28	**104**	39	15	**164**	41	10	**235**	47	8	**370**	37	4	**540**	54	4
7	28	5	20	**34**	34	1	6	**62**	62	40	**105**	42	16	**165**	56	16	**236**	59	10	**376**	47	5	**560**	28	2
8	any	5	....	**35**	28	1	4	**64**	24	15	**106**	53	20	**168**	42	10	**240**	66	11	**380**	38	4	**570**	57	4
9	54	4	24	**36**	54	1	6	**65**	39	24	**108**	54	20	**170**	34	8	**245**	49	8	**390**	39	4	**580**	58	4
10	any	4	....	**37**	37	1	3	**66**	66	40	**110**	66	24	**172**	43	10	**248**	62	10	**392**	49	5	**590**	59	4
11	66	3	42	**38**	38	1	2	**68**	34	20	**112**	28	10	**176**	66	15	**250**	25	4	**400**	30	3	**600**	30	2
12	24	3	8	**39**	39	1	1	**70**	28	16	**114**	57	20	**180**	54	12	**255**	51	8	**408**	51	5	**620**	62	4
13	39	3	3	**40**	any	1	....	**72**	54	30	**115**	46	16	**184**	46	10	**260**	39	6	**410**	41	4	**660**	66	4
14	49	2	42	**41**	41	....	40	**74**	37	20	**116**	58	20	**185**	37	8	**264**	66	10	**420**	42	4	**680**	34	2
15	24	2	16	**42**	42	....	40	**75**	30	16	**118**	59	20	**188**	47	10	**270**	54	8	**424**	53	5	**720**	54	3
16	24	2	12	**43**	43	....	40	**76**	38	20	**120**	66	22	**190**	38	8	**272**	34	5	**430**	43	4	**740**	37	2
17	34	2	12	**44**	66	....	60	**78**	39	20	**124**	62	20	**192**	24	5	**280**	28	4	**432**	54	5	**760**	38	2
18	54	2	12	**45**	54	....	48	**80**	34	17	**125**	25	8	**195**	39	8	**290**	58	8	**440**	66	6	**780**	39	2
19	38	2	4	**46**	46	....	40	**82**	41	20	**130**	39	12	**196**	49	10	**296**	37	5	**456**	57	5	**820**	41	2
20	any	2	....	**47**	47	....	40	**84**	42	20	**132**	66	20	**200**	30	6	**300**	30	4	**460**	46	4	**840**	42	2
21	42	1	38	**48**	24	....	20	**85**	34	16	**135**	54	16	**204**	51	10	**304**	38	5	**464**	58	5	**860**	43	2
22	66	1	54	**49**	49	....	40	**86**	43	20	**136**	34	10	**205**	41	8	**310**	62	8	**470**	47	4	**880**	66	3
23	46	1	34	**50**	25	....	20	**88**	66	30	**140**	28	8	**210**	42	8	**312**	39	5	**472**	59	5	**920**	46	2
24	24	1	16	**51**	51	....	40	**90**	54	24	**144**	54	15	**212**	53	10	**320**	24	3	**480**	24	2	**940**	47	2
25	25	1	15	**52**	39	....	30	**92**	46	20	**145**	58	16	**215**	43	8	**328**	41	5	**490**	49	4	**960**	24	1
26	39	1	21	**53**	53	....	40	**94**	47	20	**148**	37	10	**216**	54	10	**330**	66	8	**496**	62	5	**980**	49	2
27	54	1	6	**54**	54	....	40	**95**	38	16	**150**	30	8	**220**	66	12	**336**	42	5	**500**	25	2	**1000**	25	1
28	42	1	18	**55**	66	....	48																		

A Picture of Cincinnati Dividing Head Accuracy

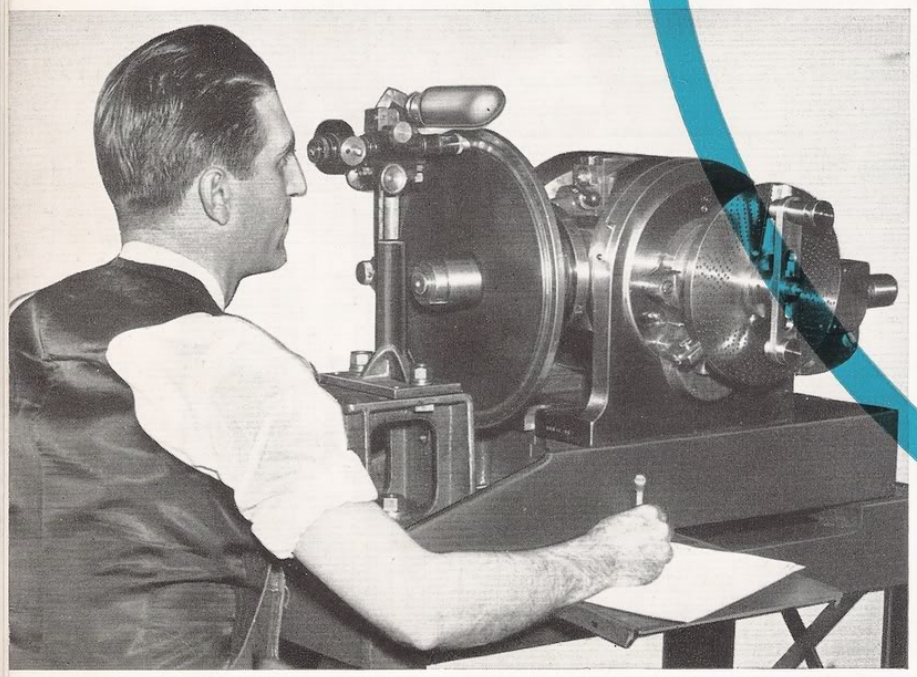


Figure 9. Checking the indexing accuracy of a CINCINNATI Dividing Head by means of an Optical Micrometer and a circular scale graduated in degrees.

This circle and the intersecting line at the left graphically illustrate CINCINNATI Dividing Head accuracy. The line, a wire .018″ in diameter, contrasted with a 12-foot diameter circle, represents to a true scale the maximum allowable accumulative error in standard CINCINNATI Dividing Heads. Actually, the wire is but $\frac{1}{25133}$ of the circumference of the circle! This is precision indexing.

Every CINCINNATI Dividing Head is thoroughly checked to give you a precision instrument of the highest order. Accuracy is built in at the start.

Fine materials, correct design, and special manufacturing facilities, combined with the workmanship of skilled craftsmen, are definitely responsible for the close accuracy and fine performance of CINCINNATI Dividing Heads.

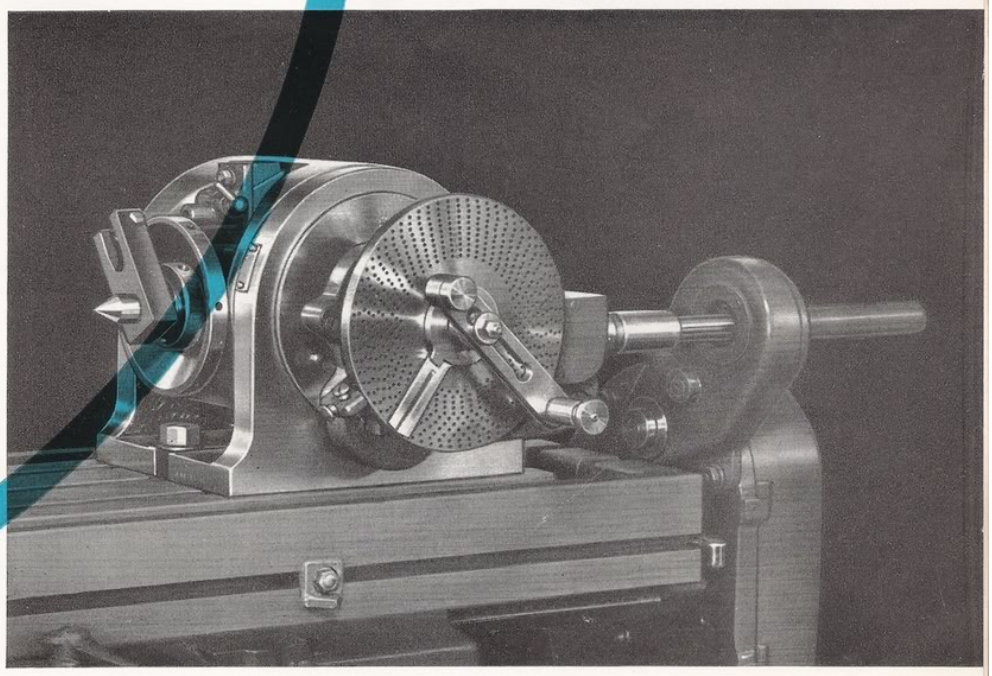


Figure 10. CINCINNATI 14″ Universal Dividing Head and enclosed Driving Mechanism, with spline shaft extension drive supplied with Nos. 3 and 4 Universal Dial Type Millers.

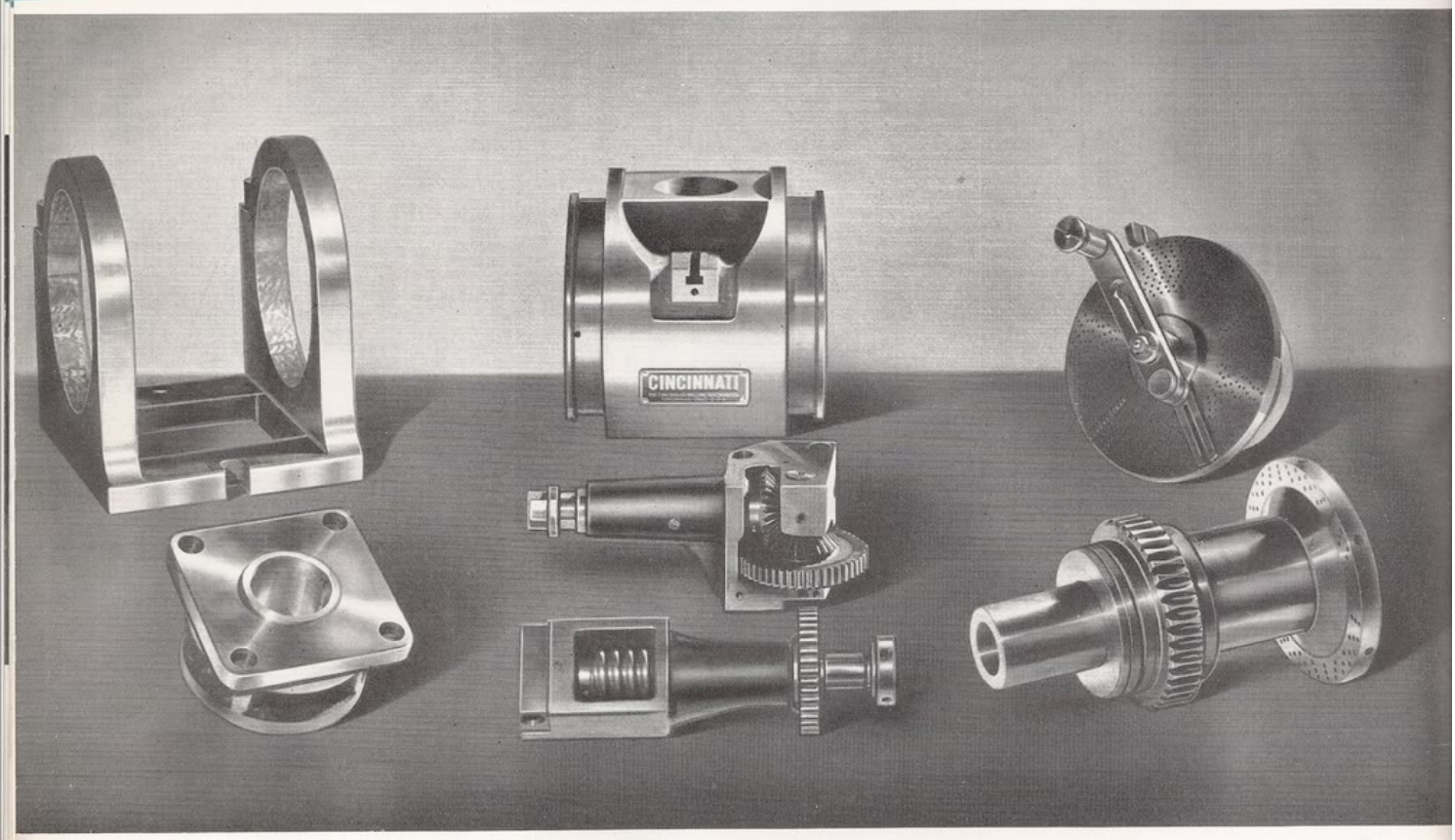


Figure 11—Sub-Assemblies of the Dividing Head and Mitre Gear Bearing
(Mitre Gear Bearing is for connection to open type Driving Mechanism—Figure 16)

SPECIFICATIONS FOR CINCINNATI DIVIDING HEAD AND TAILSTOCK

Size of Head	Actual Swing	Taper Hole in Spindle	Overall Length of Tail-stock	Overall Length of Head	Distance from End of Spindle Nose to Table when Spindle Centerline is perpendicular to Table	Net Weight Approx.		Total Shipping Weight, Approx.	Code Name All Nos. 1 and 2 Universal Machines	Code Name All Nos. 1 and 2 Plain Machines	Code Name All Nos. 3, 4 and 5 Universal Machines	Code Name All Nos. 3, 4 and 5 Plain Machines
						Dividing Head and Mitre Gear Bearing	Tailstock and Steady Rest					
10″	10½″	No. 10 B. & S.	6 13/16″	13⅛″	10 7/16″	140 lbs.	39 lbs.	230 lbs.	HYSOP	HUTER	.....	.....
12″	12½″	No. 11 B. & S.	7⅛″	15⅛″	12¼″	225 lbs.	52 lbs.	350 lbs.	HYTON	HYDRA	HUXAL	HADIV
14″	14½″	No. 11 B. & S.	7⅛″	15⅛″	13¼″	233 lbs.	55 lbs.	375 lbs.	HYTIS	HYENA	HUZOR	HEDPA

STANDARD EQUIPMENT

Tailstock with 2-Point Adjustable Center.
Steady Rest.
One Plate for Indexing through 40 to 1 Reduction.
One Plate for Direct Indexing.
One Center for Headstock fitted with Driver.
Bracket for connecting head to driving mechanism.

ATTACHMENTS and ACCESSORIES (Extra Cost)

High Number Indexing Attachment (3 plates).
Wide Range Divider (applied to the Dividing Head at Factory Only).
Compensating Dog and Driver.
Angle Plate.
3-Jaw Chuck, fitted with threaded flange.
Driving Mechanism. Note: ENCLOSED Driving Mechanisms for leads lower than 2½″ must be applied to the machine at the factory.
High Tailstock. Raising Block.

IMPORTANT—When ordering equipment listed in this circular, give serial number and letters stamped on face of column of machine on which it is to be used.

CINCINNATI DIVIDING HEAD ATTACHMENTS AND ACCESSORIES

Available at Extra Cost

Driving Mechanisms

The two standard types of driving mechanisms are illustrated in Figures 12 and 13. The open type mechanism, Figure 13, is for all former designs of CINCINNATI Milling Machines which are adaptable to milling helices. The enclosed mechanism, Figure 12, is for the newer Dial Types, and all L-type, MI and MH-Milling Machines.

Of course, a dividing head driving mechanism is a standard part of a universal milling machine. However, the driving mechanism can also be applied to plain milling machines, thereby, with the proper extra equipment, adapting them to milling a much wider range of helices than is possible on a standard universal machine.

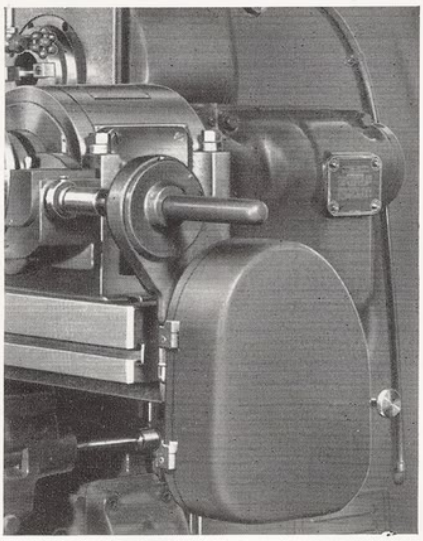
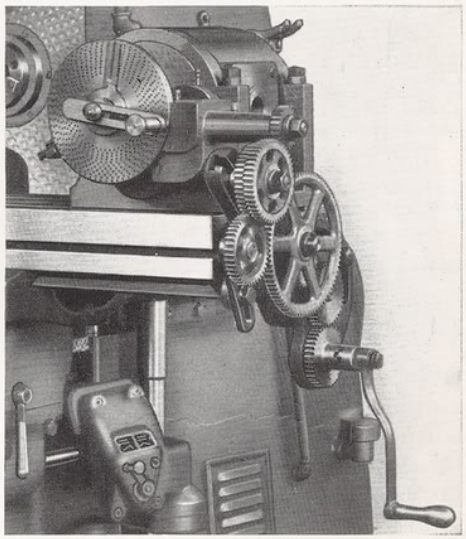


Figure 12
Enclosed Type Driving Mechanism for Dividing Heads.
NOTE—This type may also be used to drive Spiral Milling Head if extra idler segment is ordered.

Figure 13
Open Type Driving Mechanism for Dividing Heads and Spiral Milling Heads.



SPECIFICATIONS FOR DRIVING MECHANISM—OPEN TYPE

MACHINE	Net Weight	Shipping Weight	CODE NAMES—When used on: Dividing Head	Spiral Head
Nos. 1 and 2 Cone Type Nos. 1 and 2 M Type	55	70	DRON	DOOM
No. 2 L-Type	55	70	DRLD	DOLT
No. 2 MH	55	70	DRMP	DOMH
No. 3 Cone Type	55	70	DRAX	DENN
No. 4 Cone Type	55	70	DREF	DYCK
Nos. 2, 3 and 4 Medium and High-Speed Dial Type	65	80	DECRI	SPIHE
No. 2 High Power No. 3 Standard	55	70	DRIZ	DYMA
No. 3 High Power No. 4 Standard	55	70	DRUP	DYST
Nos. 4 and 5 High Power	65	80	DOXFI	DRESP

Standard Equipment—Change gears: 100, 86, 72, 64, 56, 48, 44, 40, 32, 28, and 24 (2) teeth; wood box; segment; crank; spring, and screws for attaching unit to table.

SPECIFICATIONS FOR DRIVING MECHANISM—ENCLOSED TYPE

No. 2 L-Type	65	80	DRETL	
Nos. 2MI and 2 MH	65	80	DREHM	
No. 2 Medium and High-Speed Dial Type	65	80	DREDT	
Nos. 3 and 4 Medium and High-Speed Dial Type	65	80	DREHS	

Standard Equipment—Change gears: 60, 55, 51, 48, 45, 42, 39, 36, 33, 30 27, 24 (2), 22, 21, 20, 19, 18, 17 teeth; wood box (when supplied for Dial Type only); housing; collar; crank, and screws for attaching unit to table.

Low Lead Attachment for Enclosed Type Driving Mechanism

A lead range of 1/4" to 100" is available with this attachment. It can be used only on L-Type, MI and MH universal machines, and must be built in at the factory.

Code Name for No. 2 L-Type.....DRELS.

Code Name for No. 2 MH and 2MI.....DREMR

$320.00

High Tailstock

If the angle of taper is large and the work-piece is relatively long, the high tailstock shown in Figure 14 is very useful. The center can be set at the same angle as the work-piece and adjusted endwise by means of the knob.

SPECIFICATIONS FOR HIGH TAILSTOCK

Maximum distance table to center-point....	11 1/32"
Minimum distance table to center-point....	3 21/32"
Net Weight, about.....	27 lbs.
Shipping weight, about.....	35 lbs.
Code Name { Machines with 11/16" T-Slots ..	BICK
Code Name { Machines with 13/16" T-Slots ..	BIGHT

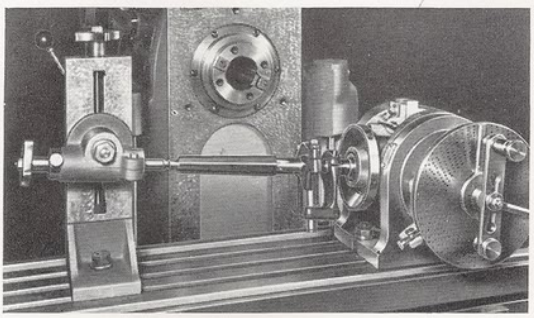


Figure 14
High Tailstock and Compensating Milling Machine Dog and Driver

Compensating Dog and Driver

Greater accuracy on taper work may be obtained by using the compensating dog and driver illustrated in Figure 14. The roller is a close fit both on the dog and in the arm of the driver, thereby imposing no strain on the work-piece and, at the same time, compensating for the gaining and loosing action which results from using the ordinary bent-tail dog.

SPECIFICATIONS FOR COMPENSATING DOG AND DRIVER

Capacity.....	1/4" to 2 3/4" diameter
Net Weight.....	3 pounds
Shipping Weight.....	4 pounds
Code Name.....	WHELK

High Number Indexing Attachment

All divisions up to and including 200, all even numbers and those divisible by 5 up to 400 (except 225, 275, 325, and 375), and many odd and even divisions higher than 400 may be obtained with the High Number Indexing Attachment, illustrated in Figure 15. The three plates which comprise the attachment are interchangeable with the standard index plate used on all Dividing Head, Spiral Milling Heads, Gear Cutting Attachments, and Plain Centers.

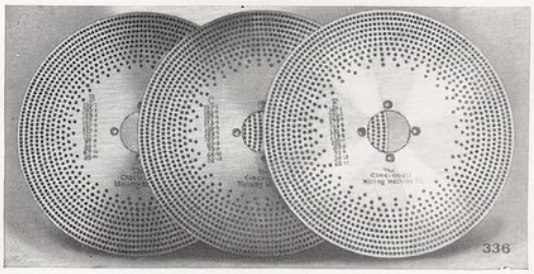


Figure 15—High Number Indexing Attachment

For complete information, write for circular. Net Weight, 18 lbs.; shipping weight, 23 lbs. Code Name—IDEAL.

Wide Range Divider

The Wide Range Divider enables you to obtain divisions ranging from 2 to 400,000. It is built into the standard Dividing Head, at the factory. For complete information, write for circular.

AND ACCESSORIES (Available at Extra Cost)

Chuck

Many dividing head jobs can be more conveniently held in a chuck than between centers. We can supply you with a 3-jaw Universal Chuck, illustrated in Figure 16, having a threaded flange for mounting it on the Dividing Head spindle nose.

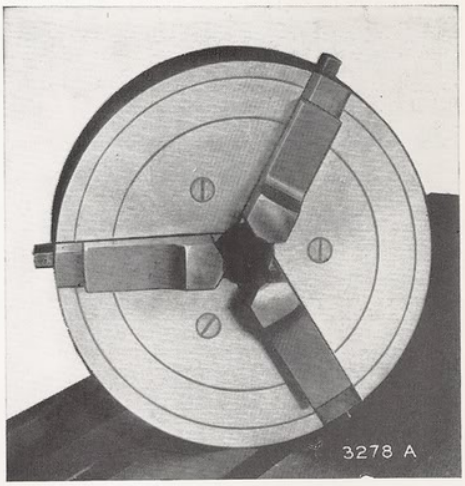


Figure 16—Dividing Head Chuck

SPECIFICATIONS FOR CHUCK

Size Head	Size Chuck	Capacity	Outside Diameter	Thread	Net Wt. Lbs.	Ship. Wt., Lbs.	Code Name
10″ Dividing	6″	¼″ to 2¾″ outside grip; ¼″ to 3½″ inside grip	6¼″	2 ″—8 thd.	22	35	SICHU
12″ & 14″ Dividing	9″	¼″—3⅛″	9 15/16″	2½″—6 thd.	40	55	CHUNI
12″ Spiral							
16″ Spiral	9″	¼″—3⅛″	9 15/16″	3¾″—4 thd.	40	55	CHUSP

Raising Block

The Raising Blocks illustrated in Figure 17 give your CINCINNATI Dividing Head the extra swing which so often is necessary for larger work. Flat and parallel clamping surfaces maintain the Dividing Head accuracy. Set-ups are simplified and quicker because these raising blocks are designed for the job. They are always supplied in matched pairs.

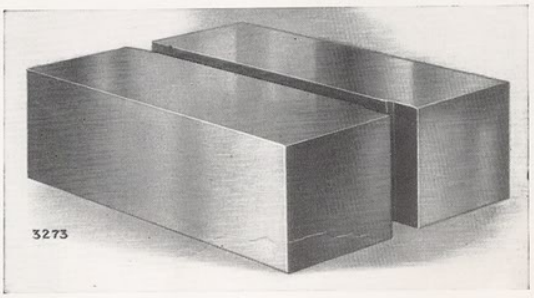


Figure 17—Raising Blocks for Dividing Heads

SPECIFICATIONS FOR RAISING BLOCKS

Size Head	Height	Width T-Slots	HEADSTOCK BLOCK Length	HEADSTOCK BLOCK Width	TAILSTOCK BLOCK Length	TAILSTOCK BLOCK Width	Net Weight	Shipping Weight	Code Name
10″	3″	13/16″ and 11/16″	10¼″	7⅝″	6⅛″	5½″	40 pounds	60 pounds	RADIV
12″	2½″	13/16″	12 9/16″	9¼″	6⅝″	6⅛″	42 pounds	62 pounds	RABHE
14″	2″	13/16″	12 9/16″	9¼″	6⅝″	6⅛″	40 pounds	60 pounds	RABOC

Angle Plate

Your Dividing Head and small fixture set-ups which are off-center or at an angle to the tableT-slots are easily and quickly completed with the aid of the Angle Plate shown in Fig. 18. Well proportioned ribs maintain flatness and rigidity. Standard size T-slots at right angles to each other are convenient when changing settings for right angle milled surfaces.

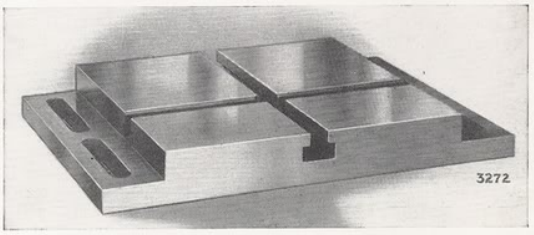


Figure 18
Angle Plate for Dividing Heads

SPECIFICATIONS FOR ANGLE PLATES

Size Head	Height	Width T-Slot	Working Surface	Size Over All	Net Weight	Shipping Weight	Code Name
10″	1 13/16″	11/16″	10¼″x10⅛″	10¼″x14⅛″	33 pounds	50 pounds	RIPLA
12″	2⅛″	13/16″	12½″x12⅜″	12½″x16⅝″	49 pounds	70 pounds	RIANP
14″	2⅛″	13/16″	12½″x12⅜″	12½″x16⅜″	49 pounds	70 pounds	RANPA

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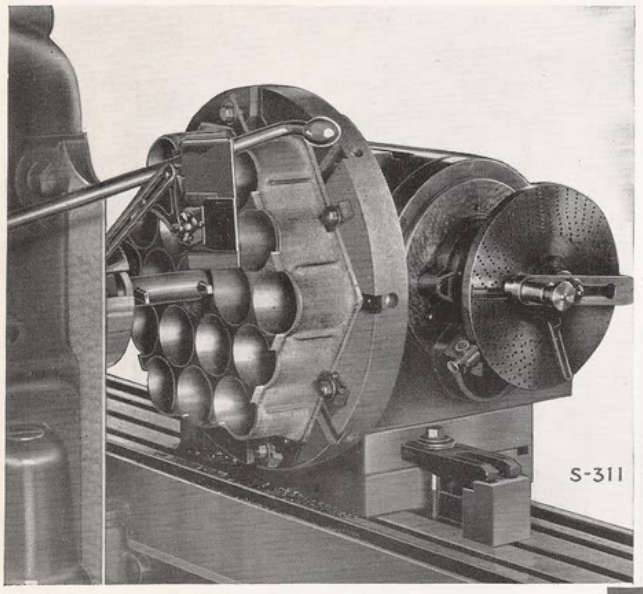

Figure 19—Nineteen holes are bored in a cast-iron cutting plate, the chordal distance from center to center of the holes (indexing accuracy) being held to a tolerance of plus or minus .0005". The user reports a 60% increase in production over the former method.

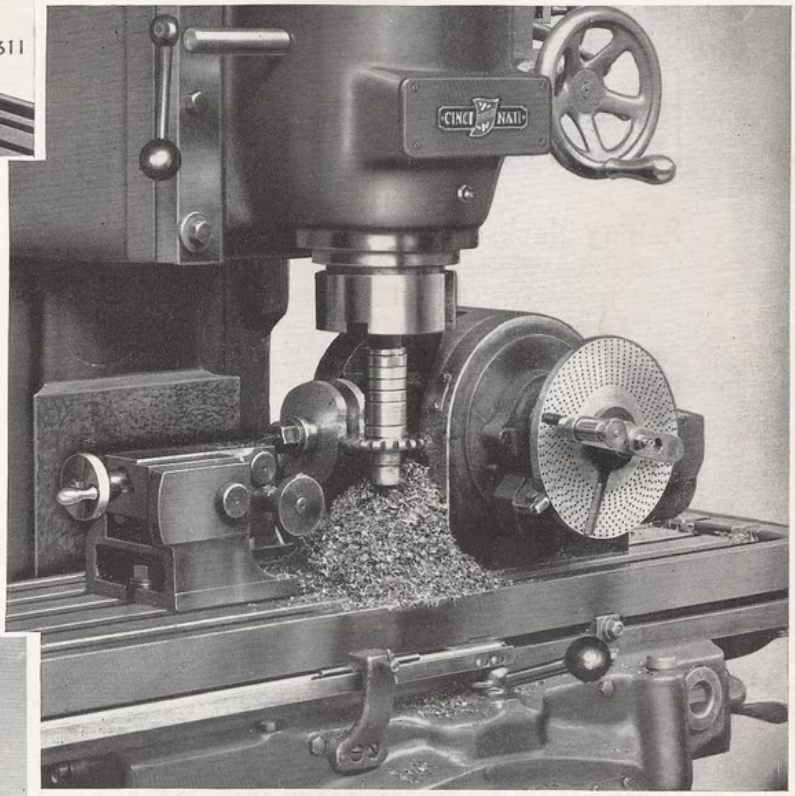

Figure 20—Conventional Dividing Head set-up of milling helical gears. This Dividing Head is equipped with a Wide Range Divider, and driven by a Short and Long Lead Attachment, mounted on a Universal Dial Type Milling Machine.

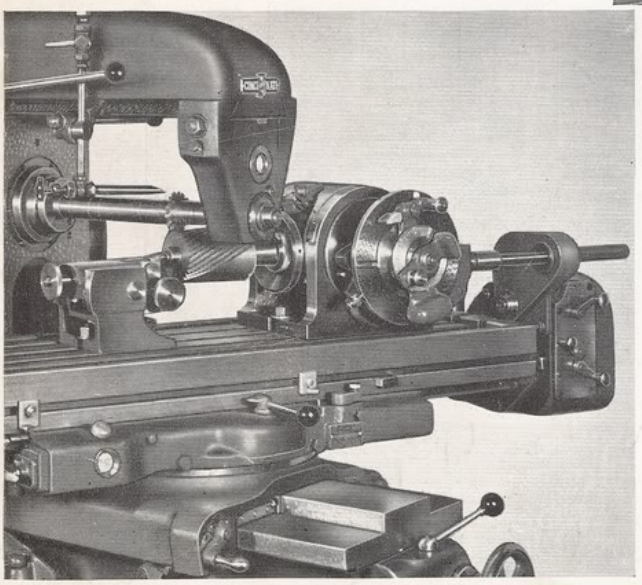

Figure 21—Milling a cam on a CINCINNATI No. 3 Vertical Dial Type Milling Machine. Here is a true test of the indexing accuracy of the Dividing Head and the accuracy of the machine. Incidentally, this installation is equipped with Precision Measuring Equipment.

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