



THIS BOOK BELONGS TO:  
KENNETH  
STOKLEY

(LATHE)

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# BETTS

## HEAVY DUTY MACHINE TOOLS



BETTS MACHINE COMPANY  
ROCHESTER N.Y., U.S.A.

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# **BETTS**

**HEAVY DUTY  
MACHINE TOOLS**



**BETTS MACHINE COMPANY**  
**ROCHESTER N.Y., U.S.A.**



# BETTS MACHINE COMPANY

Cable Address  
"BETTS" Rochester  
Iron Age Code on page 8

ESTABLISHED 1861 AT WILMINGTON, DEL.  
MOVED 1918 TO ROCHESTER, N. Y.  
ROCHESTER, N. Y., U.S.A.

Other Codes Used  
General Telegraph  
Lieber's  
Western Union

Manufacturers of Heavy Duty Machine Tools

## Products

### LATHES

Cone Head, Screw Cutting  
Geared Head, Screw Cutting  
Plain Turning  
Bevel Gear Turning  
Center Drive Axle  
End Drive Axle  
Journal Trueing

### BORING AND TURNING MILLS, VERTICAL

Fixed Upright Type  
Extension Type  
Tire Turning and Boring

### BORING MACHINES, HORIZONTAL

Boring and Drilling, Table Type  
Boring, Drilling and Milling, Floor Type

### PLANING MACHINES

Regular and Widened  
Locomotive Frame  
Cross Cutting  
Frog and Switch

### SLOTING MACHINES

### MILLING MACHINES

Multiple Spindle, Vertical, Continuous

### MUNITION MANUFACTURING MACHINES

Gun Boring and Turning  
Shell Boring and Turning  
Gun Rifling

## History of Development

During the fifty-eight years of its existence, the Betts Machine Company has been intimately connected with the development of the present heavy duty, high production, accurate machine tool. Its first machine tool was built about forty-four years after the completion of the first metal planer by Richard Roberts in 1817.

The business, which was established in Wilmington, Delaware, U. S. A., in 1861 and incorporated in 1879, has grown steadily. Its products are in daily use in all the prominent machine shops of the world, where they are known for endurance and satisfactory service.

The early part of 1918 saw the completion of negotiations, which had long been under discussion, with the result that the Bridgeford Machine Tool Works joined with the Betts Machine Company in the erection of a large modern plant



in Rochester. In this plant, just completed, Betts heavy duty tools and Betts-Bridgeford heavy duty lathes of all types are now built by the men who have been identified with the previous development of these machines. The joining of the two organizations brings together a very strong group of experienced designers and builders of heavy duty metal-working machinery.

## Export Department

This Department handles all business—correspondence, orders and shipping, for countries other than the United States of America, and Canada. It is prepared to render excellent service, using the language which is most convenient for the client.

Particular attention is given to the matter of export packing in order to secure safe delivery of goods to the purchaser and to insure the lowest freight rates and charges on shipments made on other than c.i.f. basis. Reference to the machines by type number as well as by name will help to avoid any possible confusion in correspondence.

## Betts-Bridgeford Heavy Duty Lathes

The Betts-Bridgeford line includes heavy duty lathes for boring, turning and screw cutting to fill all requirements from 26 to 72 in. (660 to 1829 mm.) swing; end and center drive lathes for coach and locomotive axles and journal trueing lathes for finishing both inside and outside journals without removing the wheels from the axles.

These are heavy duty, powerful, accurate lathes, of simple design and extremely rigid construction. They are easily controlled, are rapid and convenient in operation and are suitable for heavy cutting, for rough and finish boring, turning and screw cutting. Betts-Bridgeford lathes are widely used by forge shops, steel mills, railroad shops, ordnance and munition plants, oil well tool shops and general machine shops.

## Betts-Bridgeford Screw Cutting Lathes, 26 in. (660 mm.) and 30 in. (762 mm.) Swing, Type A1100

The head block (Figs. 2 and 3) is of rigid construction with double back-geared drive. The cone head machine is driven either by a three step or four step cone, giving respectively nine or twelve spindle speeds. The geared head type is driven by a single pulley and controlled by a friction clutch and brake for starting and stopping. All driving gears are of hardened steel and run in a bath of oil. The speeds are obtained through sliding gears and positive clutches controlled by levers on the front of the head block. The nine spindle speeds are in geometric progression. Direct connected motor drive can be furnished, if desired.

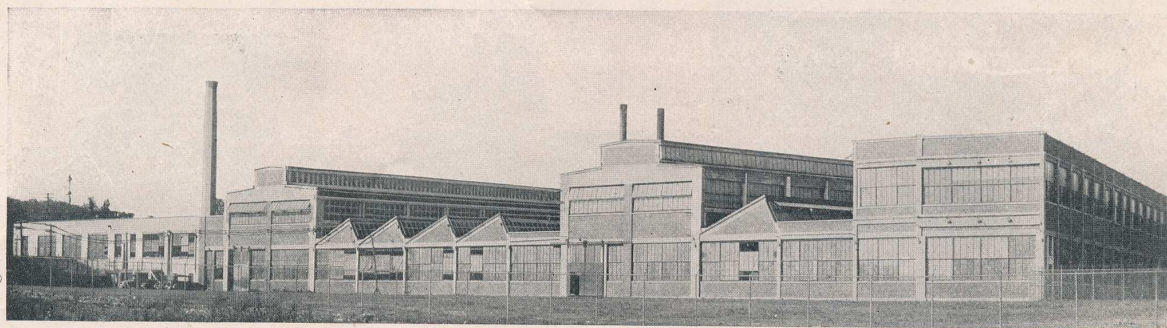


FIG. 1. MODERN PLANT OF THE BETTS MACHINE COMPANY, ROCHESTER, N. Y., U. S. A.  
This new, well equipped factory covers about 190 000 square feet (17 500 m<sup>2</sup>) of floor space.



Thirty-two changes of feed, reversible at the headstock, are obtained through the quick change gear box. Cross and longitudinal feeds are driven from a spline in the lead screw through a friction in the double walled apron. These feeds are obtained respectively through a cross feed screw on the carriage and a rack on the bed. A feed reverse is contained in the double walled apron. The screw cutting leads are obtained by means of an interlocking lever engaging a split nut with the lead screw, so that both feed and lead cannot be engaged at the same time. Either Whitworth or Metric lead screws can be furnished.

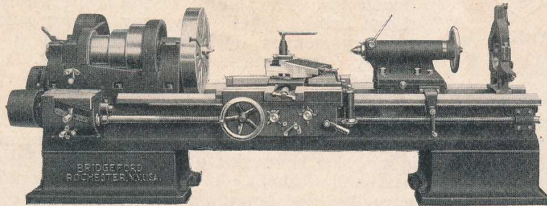


FIG. 2. BETTS-BRIDGEFORD HEAVY DUTY CONE HEAD SCREW CUTTING LATHE, TYPE A1100

Driven through double back gears. Either 3 or 4 step cone can be supplied. This machine has become practically standard in repair shops for oil well tools.

Standard equipment includes large and small face plates, compound rest for either American or English tool posts, center rest, thread indicator, quick change gear box and wrenches.

Extra attachments which can be furnished at additional cost include taper attachment, four-way turret tool post, full swing rest, follower rest, power rapid traverse to the carriage and special steady rests suited to any unusual requirements.

#### Betts-Bridgeford

Geared Head Screw Cutting Lathes,  
32 to 48 in. (813 to 1210 mm.) Swing, Type A1200

On this type of machine (Fig. 4) the head block is of rigid construction. The spindle is driven from a single pulley or direct connected motor through hardened steel

sliding gears and positive clutches running in oil to an internally geared face plate. These lathes are triple back geared with nine mechanical spindle speed changes in geometric progression, controlled by levers at the front of the head block. The spindle is driven through the internal gear for the low speeds and by a gear mounted directly on the spindle for the higher speeds. All bearings are bronze bushed and are lubricated by means of oil pump, gravity and splash systems. The face plates are arranged with parallel slots for receiving double-tongued face plate jaws.

Thirty-two changes of feed, reversible in the headstock are obtained through the quick change gear box. Cross and longitudinal feeds are driven from a spline in the lead screw through a friction in the double walled apron. These feeds

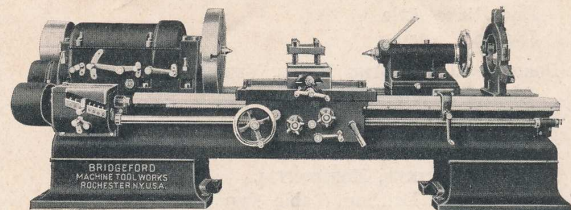


FIG. 3. BETTS-BRIDGEFORD HEAVY DUTY GEARED HEAD SCREW CUTTING LATHE, TYPE A1100

This type of 9-speed double back geared headstock is supplied on the smaller lathes. Either single pulley or motor drive can be supplied as ordered. A heavy powerful tool.

are obtained respectively through cross feed screw on the carriage and a rack on the bed. A feed reverse is contained in the double-walled apron. The screw cutting leads are obtained by means of a split nut engaging with the lead screw which is provided with an interlock, so that both feed and lead cannot be engaged at the same time. Either Whitworth or Metric lead screws can be furnished.

Standard equipment includes compound rest, center rest, thread indicator, quick change gear box and wrenches.

Extra attachments which can be furnished at additional cost include taper attachment, four-way turret tool post, full swing rest, follower rest, rear tool rest, power angular feed to the compound rest, power rapid traverse to the carriage, and special steady rests suited to any unusual requirements.

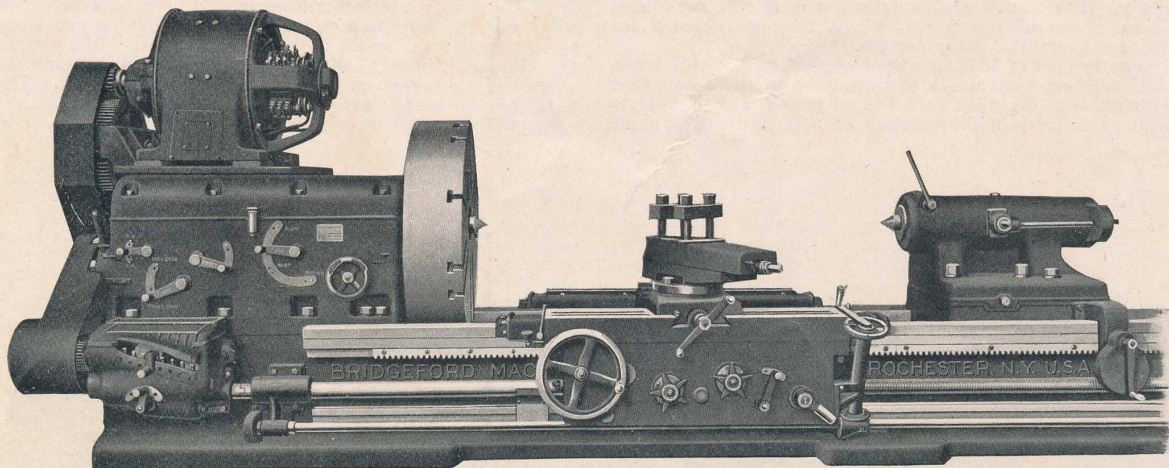


FIG. 4. BETTS-BRIDGEFORD HEAVY DUTY GEARED HEAD SCREW CUTTING LATHE, TYPE A1200

The spindle has nine speeds through triple back gears and change gears. 32 quick change feeds are provided. A powerful machine for accurate and rapid production. Single pulley drive can be furnished.



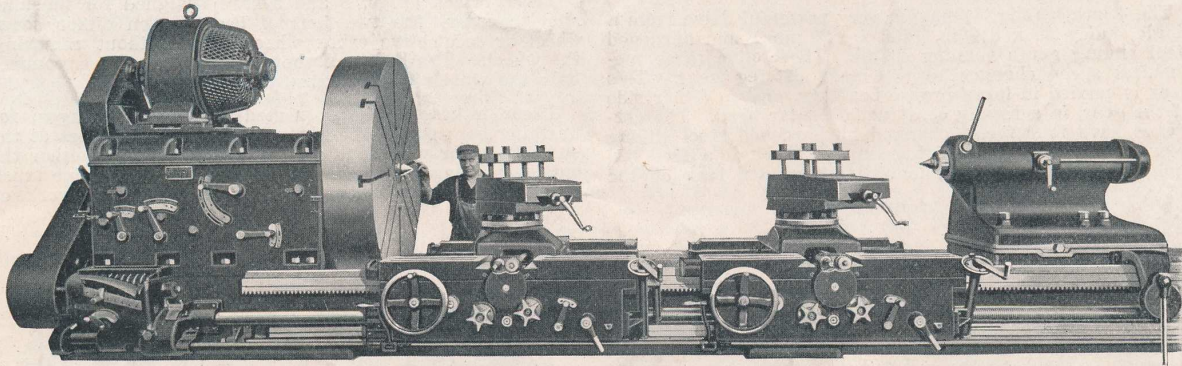


FIG. 5. BETTS-BRIDGEFORD HEAVY DUTY SCREW CUTTING LATHE, TYPE A1200

Furnished with one or more carriages, each with power angular feed as well as cross feed. The spindle is driven through internal face plate gear. 12 spindle speeds are available.

#### Betts-Bridgeford Geared Head Screw Cutting Lathes, 60 in. (1524 mm.) and 72 in. (1829 mm.) Swing, Type A1200

The drive on these lathes (Fig. 5) is similar in general to that of the smaller geared head machines. The spindle drive is always through the internally geared face plate. Twelve mechanical speed changes are provided.

The change gear box and carriage are similar to those used on the smaller lathes but are heavier in construction to take care of the greater power in these large tools.

Standard equipment includes: power angular feed to the compound tool rest; center rest; thread indicator; quick change gear box; power rapid traverse to the carriage (controlled and reversed from the operating position) and necessary wrenches.

Extra attachments which can be furnished at additional cost are: taper attachment, full swing rest, follower rest, rear tool rest and special steady rest suited to any unusual requirements.

#### Betts-Bridgeford Plain Turning Lathes, 27 in. (686 mm.) and 30 in. (762 mm.) Swing, Type A1500

These rapid production manufacturing lathes (Fig. 29), are designed for the plain turning of shafts, forgings, etc., and accurate heavy duty work where no thread cutting is required. They are driven through a single pulley 30 x 8½ in. (762 x 216 mm.) and hardened steel sliding gears running in oil. The spindle has three mechanical changes of speed. The feed gears are also of hardened steel running in oil and give four mechanical changes of feed. The feeds are controlled in the double wall apron by means of a friction. Both speeds and feeds are operated by levers at the head of the machine.

#### Bevel Gear Turning Lathe, Type A1600

For the rapid production of bevel gear ring blanks, a special type of lathe has been designed. Two compound rests are fitted with multiple tool holders so that, with two settings, a bevel gear ring can be finished all over in a very short time. Large bevel gear pinion blanks can also be handled economically. Full particulars will be given on receipt of sketches of the work to be turned.

TABLE I. SPECIFICATIONS—BETTS-BRIDGEFORD SCREW CUTTING LATHES

(1) Type.....	A1100				A1200								
(2) Machine..... in. x ft. (mm. x m.)	26x10 (660x3,0) Cone head	26x10 (660x3,0) Geared head	30x10 (762x3,0) Cone head	30x10 (762x3,0) Geared head	32x12 (813x3,7) Heavy	36x12 (914x3,7) Heavy	36x12 (914x3,7) Heavy	42x12 (1067x3,7) Heavy	42x14 (1067x4,3) Heavy	48x14 (1219x4,3) Heavy	60x20 (1524x6,1) Heavy	72x20 (1829x6,1) Heavy	
(3) Height of centers: Maximum..... in. (mm.)	13½ (343)	13½ (343)	15½ (403)	15½ (403)	17½ (451)	19½ (489)	19 (483)	21½ (546)	22 (559)	25 (635)	33 (838)	36¾ (934)	
(4) Over carriage..... in. (mm.)	8½ (225)	8½ (225)	11½ (283)	11½ (283)	11½ (283)	12½ (308)	11½ (292)	14½ (368)	14 (356)	17½ (444)	22½ (571)	27 (686)	
(5) Swing: Maximum..... in. (mm.)	27 (686)	27 (686)	31¾ (806)	31¾ (806)	35½ (902)	38½ (978)	38 (965)	43 (1092)	44 (1118)	50 (1270)	66 (1676)	73½ (1867)	
(6) Over carriage..... in. (mm.)	17½ (451)	17½ (451)	22½ (565)	22 (565)	22½ (565)	24½ (616)	32 (584)	29 (737)	28 (711)	35 (889)	45 (1143)	54 (1372)	
(7) Distance between centers..... in. (mm.)	45 (1,14)	45 (1,14)	45 (1,14)	45 (1,14)	60 (1,52)	60 (1,52)	48 (1,22)	48 (1,22)	55 (1,40)	55 (1,40)	108 (2,74)	108 (2,74)	
(8) Thread cutting range..... Threads per in. (mm. per thread)	1 to 14 (25 to 1,8)	1 to 14 (25 to 1,8)	1 to 14 (25 to 1,8)	1 to 14 (25 to 1,8)	1 to 14 (25 to 1,8)	1 to 14 (25 to 1,8)	1 to 14 (25 to 1,8)	1 to 14 (25 to 1,8)	1 to 14 (25 to 1,8)	1 to 14 (25 to 1,8)	1 to 14 (25 to 1,8)	1 to 14 (25 to 1,8)	
(9) Spindle speeds: Number.....	9*	9	9†	9	9	9	9	9	9	9	12	12	
(10) Range..... r.p.m.	6 to 260	6.5 to 166	6 to 260	6 to 260	4.6 to 108	4.6 to 108	3.9 to 100	3.9 to 100	3.7 to 98	3.7 to 98	1.9 to 41	1.9 to 14	
(11) Feeds: Number.....	32	32	32	32	32	32	32	32	32	32	32	32	
(12) Range..... in. (mm.)	0.026 to 0.370 (0.66 to 9.40)	0.026 to 0.370 (0.66 to 9.40)	0.026 to 0.370 (0.66 to 9.40)	0.026 to 0.370 (0.66 to 9.40)	0.030 to 0.429 (0.76 to 10.90)	0.030 to 0.429 (0.76 to 10.90)	0.028 to 0.392 (0.71 to 9.96)	0.028 to 0.392 (0.71 to 9.96)	0.041 to 0.576 (1.04 to 14.63)	0.041 to 0.576 (1.04 to 14.63)	0.050 to 0.696 (1.27 to 17.68)	0.050 to 0.696 (1.27 to 17.68)	
(13) Size of motor..... h.p.	56 (1,42)	56 (1,42)	58 (1,47)	58 (1,47)	58 (1,47)	60½ (1,54)	59 (1,50)	64 (1,62)	64 (1,62)	70 (1,78)	77 (1,96)	88 (2,24)	
(14) Height of machine..... in. (m.)	135x39	135x39	135x39	135x39	165x45	165x45	171x51	171x51	189x54	189x57	261x84	261x84	
(15) Floor space..... in. (m.)	(3,4x1,0)	(3,4x1,0)	(3,4x1,0)	(3,4x1,0)	(4,2x1,1)	(4,2x1,1)	(4,3x1,3)	(4,3x1,3)	(4,8x1,4)	(4,8x1,5)	(6,6x2,1)	(6,6x2,1)	
(16) Volume: Boxed for export..... cu. ft. (m³)	267 (7,6)	267 (7,6)	270 (7,6)	270 (7,6)	315 (8,9)	324 (9,2)	500 (14,2)	510 (14,4)	520 (14,7)	545 (15,4)	650 (18,4)	670 (19,0)	
(17) Per each 2 ft. (0,6 m.) added length cu. ft. (m³)	12 (0,3)	12 (0,3)	12 (0,3)	12 (0,3)	24 (0,7)	24 (0,7)	31 (0,9)	31 (0,9)	35 (1,0)	35 (1,0)	50 (1,4)	50 (1,4)	
(18) Code word: Single pulley belt drive.....	IROVO	IROVO	IRPOF	IRPOF	CUNNS	CUNRK	CUOCY	CUOLA	CUPMA	CUPPU	CURAC	CURIM	
(19) Constant speed motor drive.....	IRPIS	IRPIS	IRRAL	IRRAL	CUNPO	CUNWA	CUOJE	CUPER	CUPOW	CUPYE	CUREU	CUROZ	
(20) Variable speed motor drive.....	IRPEA	IRPEA	IRPUT	IRPUT	CUNON	CUNSI	CUODO	CUPAZ	CUPNY	CUPUK	CURBA	CURKI	

\*Three step cone drive, code word: IROAF; also furnished with 12 speeds and four step cone, code word: IROEX.

†Three step cone drive, code word: IROIP; also furnished with 12 speeds and four step cone, code word: IROLY.



### Center Drive Axle Lathes for Coach Wheel Axles, Type A1300

These lathes (Fig. 6) have a very powerful drive from a single pulley 30 x 8½ in. (762 x 216 mm.) and hardened steel sliding gears running in oil. These give three mechanical speed changes to the large driving gear. This gear is carried in large bronze bearings, one on either side of the gear, in a rigidly constructed center head. The carriages have four feeds, changed by hardened steel sliding gears running in oil, and transmitted through a feed rod and a friction in the double wall apron to a rack on the

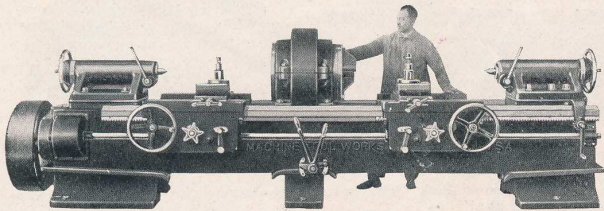


FIG. 6. BETTS-BRIDGEFORD HEAVY DUTY CENTER DRIVE AXLE LATHE, TYPE A1300

Designed for the rapid production of axles finished on wheel seats and on the journal bearings only.

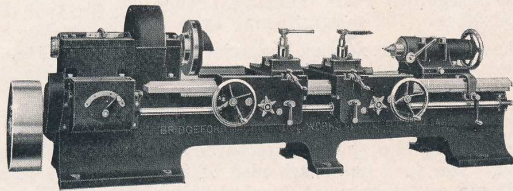


FIG. 7. BETTS-BRIDGEFORD HEAVY DUTY END DRIVE AXLE LATHE, TYPE A1300

For turning locomotive axles their full length. Capable of unusual production on this and similar classes of work.

bed. Both speeds and feeds are controlled by levers conveniently located at the center head. These tools can be furnished either in heavy duty or extra heavy pattern.

### End Drive Axle Lathes for Locomotive Wheel Axles, Type A1300

These lathes (Fig. 7) have been designed for work equally as heavy as that done on the center drive type. They handle, economically, work which has to be turned all over, such as axles for locomotive driving wheels. The drive is through a single pulley, 30 x 8½ in. (762 x 216 mm.), and hardened steel sliding gears running in oil. The spindle has three mechanical changes of speed and the carriages have four changes of feed. These lathes are furnished with either one or two carriages, in heavy duty or extra heavy pattern.

### Center Drive Journal Trueing Lathes, Type A1400

These lathes (Figs. 8 and 9) are designed for finishing simultaneously the two journal bearings on either coach wheel or locomotive truck wheel axles without removing the wheels. The bed is of the gap type, so as to accommodate the wheels on the axles.

These lathes can be furnished with two carriages, for finishing both outside bearings on coach wheel axles at the same time; or with four carriages, for finishing either the outside bearings or the inside bearings on locomotive truck axles. For shops where there is not sufficient work of

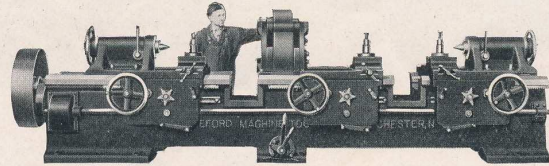


FIG. 8. BETTS-BRIDGEFORD HEAVY DUTY JOURNAL TRUEING LATHE, TYPE A1400

Equipped with three carriages to finish simultaneously both outside bearings or alternately the two inside bearings of railway coach and engine truck axles without removing wheels.

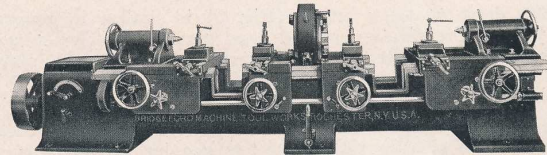


FIG. 9. BETTS-BRIDGEFORD HEAVY DUTY JOURNAL TRUEING LATHE, TYPE A1400

Four-carriage type adapted, without change, to finish both inside and outside journals, without removing wheels. The center head and driving gear open to admit the axle.

either type to keep both fully occupied, a combination axle lathe for coach wheel axles and a journal trueing machine can be furnished. This machine has three carriages and can finish the two outside bearings at one time, or can finish the two inside bearings by first turning one bearing and then reversing the axle in the lathe and finishing the other inside bearing.

These lathes are driven through a single pulley with a friction clutch for spindle control, and through hardened steel sliding gears running in oil. The driving gear at the center head, which is carried between two bronze bearings, has three mechanical changes of speed. This gear is made in two sections and opens with the center head, so that an axle with wheels mounted can be placed on the lathe centers. The carriages have four feeds. The hardened steel feed gears run in oil. Both feeds and speeds are controlled by levers located near the center head.

TABLE II. SPECIFICATIONS—BETTS-BRIDGEFORD AXLE TURNING, JOURNAL TRUEING AND PLAIN TURNING LATHES

(1)	Type	Axle Turning, Type A1300				Journal Trueing, Type A1400				Plain Turning Type A1500	
		End Drive Heavy Duty	End Drive Extra Heavy	Center Drive Heavy Duty	Center Drive Extra Heavy	Two Carriages	Three Carriages	Four Carriages			
(2)	Pattern										
(3)	Height of centers: Over way.....in. (mm.)	9¾ (248)	13½ (343)	9¾ (248)	13½ (343)	13½ (343)	13½ (343)	13½ (343)	13½ (343)	15 (381)	
(4)	Over carriage.....in. (mm.)	5 (127)	6¾ (171)	5 (127)	6¾ (175)	6¾ (171)	6¾ (171)	6¾ (171)	6¾ (171)	11¼ (286)	
(5)	Swing: Over way.....in. (mm.)	19½ (495)	27 (686)	19½ (495)	27 (686)	27 (686)	27 (686)	27 (686)	27 (686)	30 (762)	
(6)	Over carriage.....in. (mm.)	10 (254)	13½ (343)	10 (254)	13¾ (349)	13½ (343)	13½ (343)	13½ (343)	13½ (343)	22½ (572)	
(7)	In gap, standard.....in. (mm.)					45 (1143)	45 (1143)	45 (1143)			
(8)	In gap, special.....in. (mm.)					55 (1397)	55 (1397)	55 (1397)			
(9)	Length of bed.....ft.-in. (m.)	14-0 (4,27)	14-6 (4,42)	14-0 (4,27)	14-0 (4,27)	14-6 (4,42)	14-6 (4,42)	14-6 (4,42)	12-0 (3,66)	12-0 (3,66)	
(10)	Distance between centers.....ft.-in. (m.)	8-6 (2,59)	8-6 (2,59)	8-6 (2,59)	8-6 (2,59)	8-6 (2,59)	8-6 (2,59)	8-6 (2,59)	6-0 (1,83)	6-0 (1,83)	
(11)	Minimum.....ft.-in. (m.)					4-6 (1,37)	4-6 (1,37)	4-6 (1,37)			
(12)	Size of motor.....h.p.	15	25	15	25	10	25	10	25	25	
(13)	Length of machine.....ft.-in. (m.)	14-0 (4,27)	16-0 (4,88)	15-3 (4,65)	15-3 (4,65)	17-0 (5,18)	17-0 (5,18)	17-0 (5,18)	13-6 (4,11)	13-6 (4,11)	
(14)	Width of machine.....in. (m.)	40 (1,0)	48 (1,2)	40 (1,0)	48 (1,2)	48 (1,2)	48 (1,2)	48 (1,2)	48 (1,2)	48 (1,2)	
(15)	Height of machine.....in. (m.)	56 (1,4)	56 (1,4)	56 (1,4)	56 (1,4)	56 (1,4)	56 (1,4)	56 (1,4)	56 (1,4)	56 (1,4)	
(16)	Volume: Boxed for export.....cu. ft. (m³)	265 (7,5)	369 (10,4)	265 (7,5)	369 (10,4)	390 (11,0)	390 (11,0)	390 (11,0)	369 (10,4)	369 (10,4)	
(17)	Per each 2 ft. (0,6 m.) added length cu. ft. (m³)	35 (1,0)	42 (1,2)	35 (1,0)	42 (1,2)	42 (1,2)	42 (1,2)	42 (1,2)	42 (1,2)	42 (1,2)	
(18)	Code word: Belt drive.....	CUKIR	CUKTR	CUJY	CUJLI	CULBI	CULFV	CULUV	CUMRE	CUMRE	
(19)	Constant speed motor drive.....	CUKRY	CULAK	CUJFY	CUKAH	CULFC	CULO	CUMAN	CUMPI	CUMUY	
(20)	Variable speed motor drive.....	CUKMI	CUKWO	CUJEV	CUJOB	CULDE	CULGY	CULYS	CUMMO	CUMTA	



**Betts Heavy Duty Vertical Boring and Turning Mills, Type A2100**

The smallest boring mill manufactured by this Company is the 5 ft. (1.52 m.) heavy pattern having a capacity of 65 in. (1.65 m.) in diameter (Fig. 13). From this the range of sizes increases up to any required capacity (Figs. 10, 11, and 13). Specifications are given here only on machines up to 30 ft. (9.14 m.), but information on larger machines will be mailed to those interested. In most of the sizes, either heavy or extra heavy machines can be furnished. In addition, there are several sizes of extra heavy double driven machines, as shown in the tables. The extension type of mill (Fig. 12) will be found listed in Table IV. The smallest of this type is the 10-16 ft. (3.05-4.88 m.) machine. From this size they range up to 16-25 ft. (4.88-7.62 m.) machines.

These boring mills are designed for heavy duty service and can be depended upon for rapid production and accuracy. They are heavy, sturdy tools, particularly suited for work of the large, heavy class where unusual cuts must be taken

pinion and the internal gear insures a smooth drive, strength and great dependability, on account of the thicker tooth root of the internal gear. On boring mills up to and including 16 ft. (4.88 m.) provision is made for twelve table speeds and, on larger tools, for twenty-four speeds. The bed is of deep box form, designed for each size of machine, to resist the heaviest weights and cutting strains. The table track is automatically lubricated. An adjustable step bearing provides for relieving slightly the pressure on the table track when operating at high speed.

Eight positive all geared feeds are provided. These range from 0.024 to 1 in. (0.6 to 25.40 mm.), operate at any angle and are independent in all their movements. The location of all controlling handles and levers has been carefully studied with reference to their accessibility from the operating position. A patented device (Fig. 14), exclusive with Betts boring mills, is attached to each saddle and this gives the operator absolute control of all tool movements at all times from one operating position.

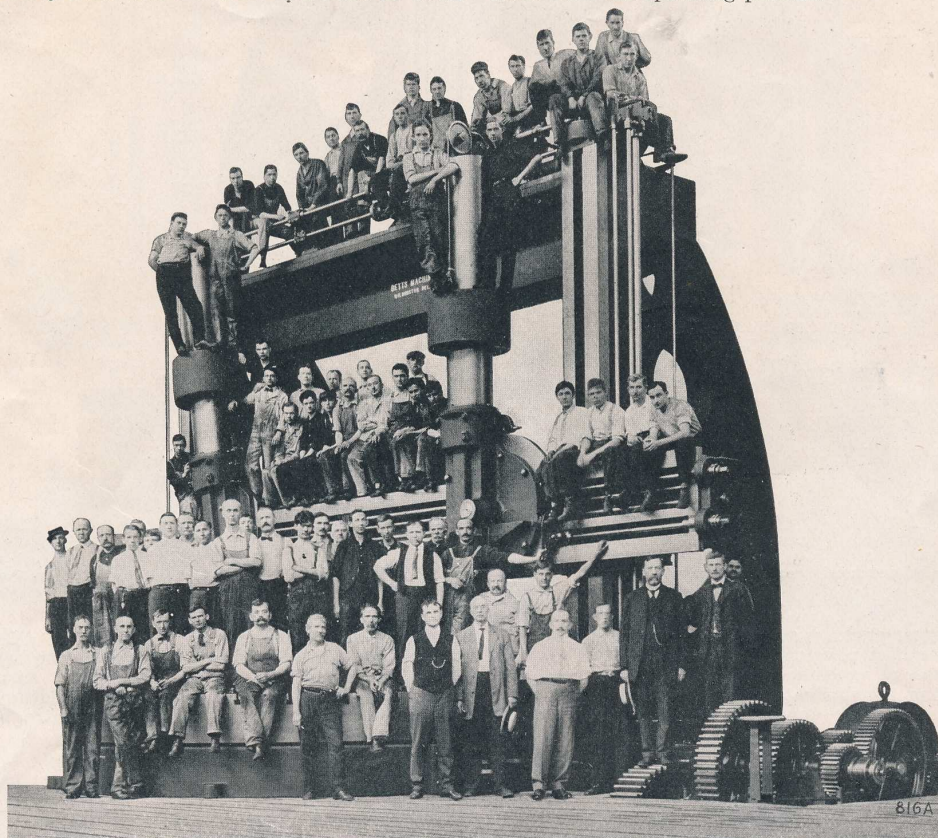


FIG. 10. LARGE BETTS BORING MILL UNDER CONSTRUCTION, SHOWING SIZE AND RELATIVE WEIGHTS OF THE UNITS COMPOSING IT

and accurate jobs produced in as short a time as possible. However, they have proven equally satisfactory on work of the small, light class. The fact that they are in daily use in railroad shops, shipyards, steel mills, automobile manufacturing plants, general manufacturing plants, Government Arsenals and Navy Yards, gives an idea of the great variety of uses to which they can be put.

Simplicity of design is one of the outstanding characteristics of these tools. There are no intricate or complicated parts to become a source of annoyance or loss through breakdown or excessive wear. Each part has been designed in correct relation to the whole machine and to the work it has to do; the result is a heavy, powerful machine, consistent in design and construction throughout. Rigid inspection of all parts and inspection under running test of the finished machine insures the production of a machine of uniform accuracy and dependability.

The drive is through an internal spur gear of wide face and coarse pitch. The long arc of contact between the

Both heads and tool spindles are regularly provided with power rapid traverse, which operates at the rate of about 6 ft. (1.83 m.) per minute, to enable the operator to move them to any desired position quickly and without effort. The cross rail is provided with power elevation through separate motor which also operates the power rapid traverse. In the accompanying table, two motors will be found listed for each size of machine, the larger of which is the main drive motor and the smaller for the power rapid traverse and for raising and lowering the cross rail.

It should be noted that the thread on both elevating screws is cut in the same hand, insuring parallelism with each change in height.

The extension type of mills (Fig. 12) embodies all the excellent features of the standard machines and, in addition, their range has been increased by making the uprights movable forward and back, and by adding an extension arm. The Betts Patented Extension Arm has eliminated the difficulties experienced with the usual construction. This arm is



fastened directly to and moves with the cross rail; unlike other makes it is stiffened by a triangular brace supported and guided by a rigid bracket fastened to the cross girt. Constructed thus the arm is really an integral part of the machine, as the stresses set up in it are transmitted directly to the uprights. The extension arm has on it a third swiveling head and tool spindle which permits

forward—very economically. At the same time it has capacity for the occasional large job.

The machines are arranged for single pulley, variable speed or constant speed motor drive—to suit the user's requirements. To accomplish certain jobs, attachments of more or less special nature are required; a slotting and key seating attachment in connection with one of the tool

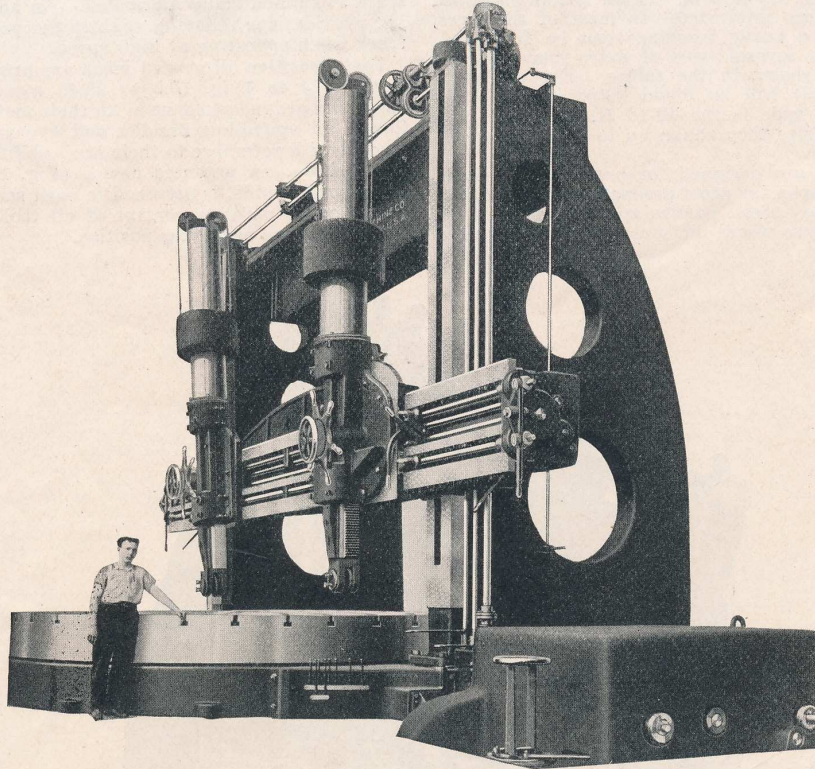


FIG. 11. BETTS HEAVY DUTY VERTICAL BORING AND TURNING MILL, TYPE A2100

Tool spindles are independently counterbalanced—Betts standard construction. Greater rigidity is obtained by wide web on cross girt. Rapid traverse from elevating motor.

boring to the center of the work with the uprights extended back to their farthest position.

With this type of machine an additional motor is required for moving the uprights. The advantages are that it will handle small work—up to its capacity with upright

spindles makes it possible to accomplish difficult boring, turning and slotting or key-seating on the same machine without changing the set-up; the pulley turning attachment is sometimes a highly productive addition; threading and grooving attachment, side head, centre boring head,

TABLE III. BETTS HEAVY DUTY VERTICAL BORING AND TURNING MILLS, TYPE A2100

Size	Actual swing*	Height under tools	Tool spindle travel	Diameter table	Motors	Floor space (width and length)	Height	Cubic feet	CODE WORD		
									Belt drive	Constant speed motor drive	Variable speed motor drive
ft. (m.)	ft.-in. (m.)	in. (mm.)	in. (mm.)	in. (mm.)	h.p.	ft.-in. (m.)	ft.-in. (m.)	cu. ft. (m <sup>3</sup> )			
5 (1.52)	5-5 (1.65)	47 (1194)	30 (762)	57 (1448)	12½ and 3½	14-6x10-6 (4.42x3.20)	12-6 (3.81)	600 (17.0)	COMYA	CONET	CONAB
6 (1.83)	6-5 (1.96)	50 (1270)	30 (762)	68 (1727)	12½ and 4	15-9x11-6 (4.80x3.51)	12-6 (3.81)	750 (21.2)	CONUM	COPEZ	COPAH
7 (2.13)	7-4 (2.24)	50 (1270)	30 (762)	78 (1981)	12½ and 4	16-6x12-0 (5.03x3.66)	13-0 (3.96)	850 (24.0)	COPIR	COPRY	COPMI
8 (2.44)	8-4 (2.54)	62 (1890)	36 (914)	84 (2134)	20 and 5	21-0x12-0 (6.40x3.66)	14-6 (4.42)	950 (26.8)	COSUY	COTAT	COSWU
10 (3.05)	10-4 (3.15)	62 (1890)	36 (914)	108 (2743)	20 and 5	23-0x12-0 (7.01x3.66)	14-6 (4.42)	1100 (31.1)	COTEL	COTON	COTMU
12 (3.66)	12-4 (3.76)	75 (2286)	48 (1219)	120 (3048)	25 and 7½	25-6x13-6 (7.77x4.11)	16-9 (5.11)	1500 (42.5)	COVMA	COVOW	COVNY
14 (4.27)	14-3 (4.34)	75 (2286)	48 (1219)	120 (3048)	25 and 7½	27-6x13-6 (8.38x4.11)	16-9 (5.11)	1540 (43.6)	COWHO	COVWI	COWIM
16 (4.88)	16-3 (4.95)	96 (2926)	60 (1524)	120 (3048)	35 and 7½	28-9x13-9 (8.76x4.19)	22-6 (6.86)	1900 (53.8)	COXPA	COXTS	COXSU
20 (6.10)	20-3 (6.17)	146 (3708)	72 (1829)	168 (4267)	50 and 12½	33-6x18-0 (10.21x5.49)	27-6 (8.38)	3450 (97.6)	—	COZIV	COZGE
EXTRA HEAVY TYPE											
6 (1.83)	6-4 (1.93)	50 (1270)	30 (762)	72 (1829)	20 and 5	17-0x10-6 (5.18x3.20)	13-0 (3.96)	800 (22.6)	CONIL	CONTO	CONNA
7 (2.13)	7-4 (2.24)	50 (1270)	30 (762)	84 (2134)	20 and 5	18-6x11-0 (5.64x3.35)	13-6 (4.11)	900 (25.5)	COPTU	COSAN	COPWO
10 (3.05)	10-4 (3.15)	75 (2286)	48 (1219)	120 (3048)	25 and 5	23-6x13-6 (7.16x4.11)	16-9 (5.11)	1400 (39.6)	COTPO	COTWA	COTSJ
12 (3.66)	12-4 (3.76)	96 (2926)	60 (1524)	120 (3048)	30 and 7½	24-0x17-6 (7.32x5.33)	22-0 (6.71)	1720 (48.7)	COVPU	COVYE	COVUK
14 (4.27)	14-3 (4.34)	96 (2926)	60 (1524)	120 (3048)	30 and 7½	26-0x17-6 (7.92x5.33)	22-0 (6.71)	1800 (51.0)	COWOZ	COXEX	COWUN
EXTRA HEAVY DOUBLE DRIVE TYPE											
8 (2.44)	8-4 (2.54)	62 (1890)	42 (1067)	96 (2926)	25 and 5	19-0x14-0 (5.79x4.27)	15-6 (4.72)	1000 (28.3)	—	COSTA	COSRE
10 (3.05)	10-4 (3.15)	75 (2286)	48 (1219)	120 (3048)	35 and 7½	22-0x16-0 (6.71x4.88)	20-9 (6.33)	1500 (42.5)	—	COVAZ	COUDO
12 (3.66)	12-4 (3.76)	96 (2926)	60 (1524)	144 (3658)	35 and 7½	24-0x19-6 (7.32x5.94)	22-0 (6.71)	1800 (51.0)	—	COWEU	COWBA
16 (4.88)	16-3 (4.95)	120 (3048)	72 (1829)	168 (4267)	50 and 10	33-0x17-9 (10.06x5.41)	28-0 (8.53)	3500 (99.1)	—	COYIS	COYHU
20 (6.10)	20-3 (6.17)	146 (3708)	72 (1829)	216 (5486)	50 and 12½	38-0x20-6 (11.58x6.25)	34-0 (10.36)	5460 (154.5)	—	COZU	COZTY
25 (7.62)	25-3 (7.70)	146 (3708)	72 (1829)	240 (6096)	50 and 15	44-0x22-6 (13.41x6.86)	39-0 (11.89)	6200 (175.5)	—	CRAI	CRAEM
30 (9.14)	30-3 (9.22)	146 (3708)	72 (1829)	288 (7315)	50 and 15	49-0x24-0 (14.94x7.32)	43-0 (13.11)	7200 (203.8)	—	CRAOR	CRAENT

\*Diameter of work.



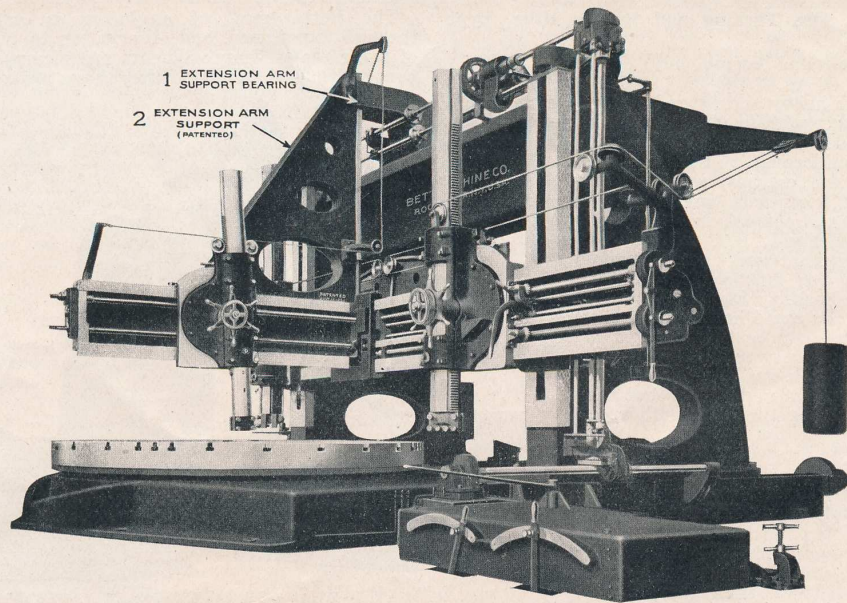


FIG. 12. BETTS HEAVY DUTY EXTENSION BORING AND TURNING MILL, TYPE A2200  
The extension boring arm (standard equipment) has Betts patented support guided by a bearing from the cross girt. Uprights are moved by power to any position in their range.

traveling head boring bar and back head are extras which can in some cases be used to distinct advantage.

Leadership in the development of this class of machines has been maintained by Betts boring mills because of their simplicity and ease of operation together with a heavy build, powerful drive and rigidity under heavy cuts, plus their exceptionally wide range of usefulness.

Convenient control of saddle and tool spindle movement is an important feature of Betts heavy duty boring and turning mills. The power rapid traverse enables the operator to set his tools quickly and with little effort. Movement of saddle or tool spindle is selected by the shifting to right or left of the lever on the end of the cross-rail. Feed or power rapid traverse is determined by the position of the control

lever on the saddle or by a connected lever at the feed change gear box. Similarly the direction of either of these movements is controlled by hand levers, one on the saddle and one at the feed box. This control of direction operates through friction clutches.

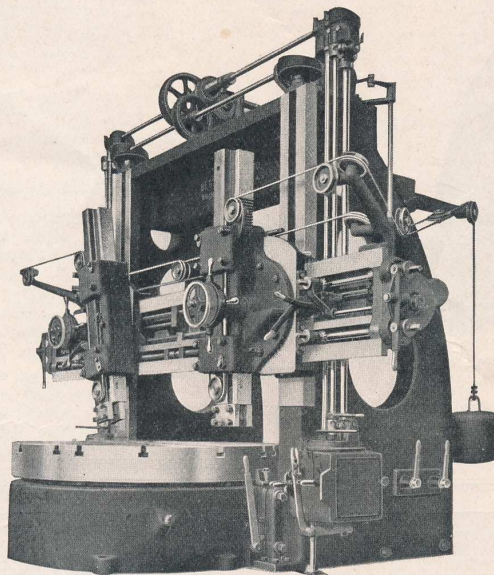


FIG. 13. BETTS HEAVY DUTY VERTICAL BORING AND TURNING MILL, TYPE A2100

Table is driven by internal gear and pinion—Betts standard construction. Both saddles and tool spindles have power rapid traverse operated from the floor or the heads. All geared feeds through-

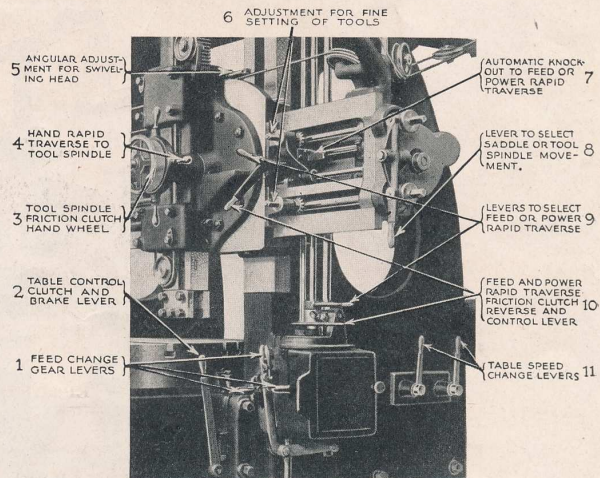


FIG. 14. DETAIL OF CONVENIENT DUPLEX CONTROL OF BETTS BORING MILLS

TABLE IV. BETTS HEAVY DUTY EXTENSION BORING AND TURNING MILLS, TYPE A2200

	10-16 (3,05-4,88)	12-18 (3,66-5,49)	14-20 (4,27-6,10)	16-25 (4,88-7,62) *
(1) Size of machine.....ft. (m.)				
(2) Swing†: Uprights				
forward ft.-in. (m.)	10-4 (3,15)	12-4 (3,76)	14-5 (4,39)	16-4 (4,98)
(3) Uprights back ft.-in. (m.)	16-2 (4,93)	18-2 (5,54)	20-2 (6,15)	25-2 (7,67)
(4) Height under tools ft.-in. (m.)	6-0 (1,83)	8-0 (2,44)	9-0 (2,74)	10-0 (3,05)
(5) Tool spindle travel ft.-in. (m.)	4-0 (1,22)	6-0 (1,83)	6-0 (1,83)	6-0 (1,83)
(6) Motor: Driving.....h.p.	25	25	35	50
(7) Rail moving and rapid traverse.....h.p.	7½	10	10	15
(8) Upright moving.....h.p.	7½	10	10	15
(9) Width, across front ft.-in. (m.)	23-0 (7,01)	26-0 (7,92)	30-6 (9,30)	34-0 (10,36)
(10) Length, back to front ft.-in. (m.)	20-0 (6,10)	24-0 (7,32)	28-0 (8,53)	34-0 (10,36)
(11) Height.....ft.-in. (m.)	19-0 (5,79)	24-0 (7,32)	28-0 (8,53)	30-0 (9,14)
(12) Volume.....cu. ft. (m³)	1590 (45,0)	2160 (61,2)	2600 (73,7)	4250 (120,0)
(13) Code word: Belt drive.....	CUDPH	CUELT	CUEVY	CUEFK
(14) Constant speed motor drive	CUDYO	CUESE	CUFAS	CUEFC
(15) Variable speed motor drive	CUDUX	CUENO	CUEXU	CUFFI

\* Double drive. † Maximum diameter of work.







### Betts Heavy Duty Horizontal Boring and Drilling Machine, Type A3100

Betts horizontal boring and drilling machines (Fig. 17) are made in three sizes: No. 1 with a 3½ in. (89 mm.) spindle; No. 2 with a 4½ in. (114 mm.) spindle; No. 3 with a 5½ in. (140 mm.) spindle.

These machines can be used with equal success on small work demanding great precision or on heavy boring or drilling within their range. A need for machines of this type exists in nearly every shop. They are general purpose tools, and can be used especially on production work to suit the particular need of the moment.

Complication in design has been carefully avoided; construction follows the lines of simplicity and utility. The spindle is of special hammered high carbon steel, accurately ground and with a full bearing in the cast iron sleeve through which it is fed by means of rack and pinion. The position of the head is fixed, and the table is raised or lowered by means of two screws, worm wheels and worms driven by power. A cross table is provided with transverse and longitudinal adjustment, which facilitates quick setting of the work.

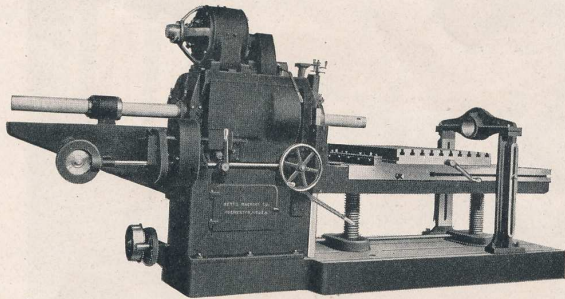


FIG. 17. BETTS HEAVY DUTY HORIZONTAL BORING AND DRILLING MACHINE, TYPE A3100

Furnished either motor driven, as shown, or with cone pulley. Can be equipped with milling feeds and with rotary table.

TABLE VI. BETTS HEAVY DUTY HORIZONTAL BORING AND DRILLING MACHINES, TYPE A3100

	No. 1	No. 2	No. 3
(1) Spindle diameter.....in. (mm.)	3½ (89)	4½ (114)	5½ (140)
(2) Max. distance, spindle to table.....in. (mm.)	33 (838)	38 (965)	41 (1041)
(3) Max. dist., spindle to cross table.....in. (mm.)	25 (635)	31 (787)	34 (864)
(4) Spindle travel (2 settings).....in. (mm.)	48 (1219)	60 (1524)	60 (1524)
(5) Length of table.....in. (mm.)	72 (1829)	96 (2438)	120 (3048)
(6) Width of table.....in. (mm.)	26¼ (667)	32½ (826)	37 (940)
(7) Length of cross table.....in. (mm.)	36 (914)	48 (1219)	60 (1524)
(8) Width of cross table.....in. (mm.)	24 (610)	36 (914)	48 (1219)
(9) Diameter of circular table.....in. (mm.)	25 (635)	32 (813)	42 (1067)
(10) Motor required.....h.p.	5	7½	10
(11) Floor space.....ft.-in.	14-6x6-10	18-0x7-10	21-6x11-8
(m.)	(4,42x2,08)	(5,49x2,39)	(6,53x3,56)
(12) Height.....ft.-in. (m.)	6-0 (1,83)	7-0 (2,13)	7-6 (2,29)
(13) Weight: Net.....lb. (kg.)	12400 (5625)	19100 (8650)	32300 (14650)
(14) Boxed for export.....lb. (kg.)	13100 (5950)	20000 (9075)	34000 (15400)
(15) Volume, boxed for export (special) cu.ft. (m³)	364 (10,3)	529 (15,0)	833 (23,6)
(16) Code word: Belt drive.....	ISGIR	ISHEC	ISIAN
(17) Constant speed motor drive.....	ISHAX	ISHYS	ISHOK
(18) Variable speed motor drive.....	ISGUS	ISHUV	ISIM0

The geared feeds are positive and reversible and the spindle may be fed in either direction without reversing its motion. Rectangular guides are provided on all sliding surfaces. The machines are amply proportioned to accommodate large pieces of work and to withstand strains in excess of anything they will be called upon to handle.

All controls are centralized at the operating position to insure maximum speed in operation and production.

One facing head is provided with the machine, but others can be had at additional cost. Graduated circular table, power feeds to all tables, thread cutting attachment to spindles, special boring bars and bushings can be furnished as extras.

The machines can be arranged for cone belt drive, for variable or constant speed motor drive to suit the requirements. Motor driven machines are provided with friction clutch and brake control of the spindle. One of the characteristics of machines of this type is their wide range of adaptability to all sorts of jobs and conditions. The Betts horizontal machines are far advanced in this field, and, to make them thoroughly modern, improvements are continually being incorporated as standard equipment.

The design of this tool is consistently heavy throughout. It is thoroughly modern and embodies many unusual refinements and aids to production.

### Betts Heavy Duty Horizontal Boring, Drilling and Milling Machine, Floor Type A3200

This machine (Fig. 18) is built in but one size with a 5½ in. (140 mm.) dia. spindle. This can be increased to 6 in. (152 mm.). The size of floor plate and travel of column may be varied to suit the particular needs of the user.

Primarily a tool for heavy service, its accuracy, wide range of adaptability and rapidity in production have made it popular in nearly every industry using heavy tools. Though following the general construction of machines of this type, the design is characterized by its simplicity. The absence of complicated parts results in freedom from breakdowns and in increased production. The spindle is of special high carbon hammered steel, accurately ground and with a full bearing at all times in its cast iron sleeve. It can be traveled by hand or power in either direction. The table is of heavy build, with conveniently located T-slots. Bed and column are designed for heavy work and have graduated steel scales for accurate adjustment. Both column and carriage have power feeds and rapid traverse in either direction. Positive and reversible drilling, boring and milling feeds are obtained through change gears. The steady rest has a rapid hand movement and is provided with a graduated steel scale.

Special facing heads, boring bars or bushings can be ordered in addition to the regular equipment. The standard size of the table or floor plate is 6 x 11½ ft. (1.83 x 3.51 m.), but this, as well as the horizontal travel of column and steady rest may be varied to suit individual requirements. The machine is arranged for single pulley drive, variable, or constant speed motor drive. All controls are conveniently located at the operating position.

TABLE VII. BETTS HEAVY DUTY HORIZONTAL BORING, DRILLING AND MILLING MACHINE, TYPE A3200

(1) Spindle diameter.....	5½ or 6 in. (140 or 152 mm.)
(2) Spindle travel (horizontal).....	49 in. (1245 mm.)
(3) Carriage travel (vertical).....	49 in. (1245 mm.)
(4) Column travel.....	73 in. (1854 mm.)
(5) Spindle to bed, maximum distance.....	74 in. (1880 mm.)
(6) Spindle to bed, minimum distance.....	25 in. (635 mm.)
(7) Size of motor required.....	10 h.p.
(8) Length of machine.....	22 ft. 6 in. (6,86 m.)
(9) Width of machine.....	14 ft. 6 in. (4,42 m.)
(10) Height of machine.....	12 ft. (3,66 m.)
(11) Code word: Belt drive.....	ISJON
(12) Constant speed motor drive.....	ISKAW
(13) Variable speed motor drive.....	ISKOT

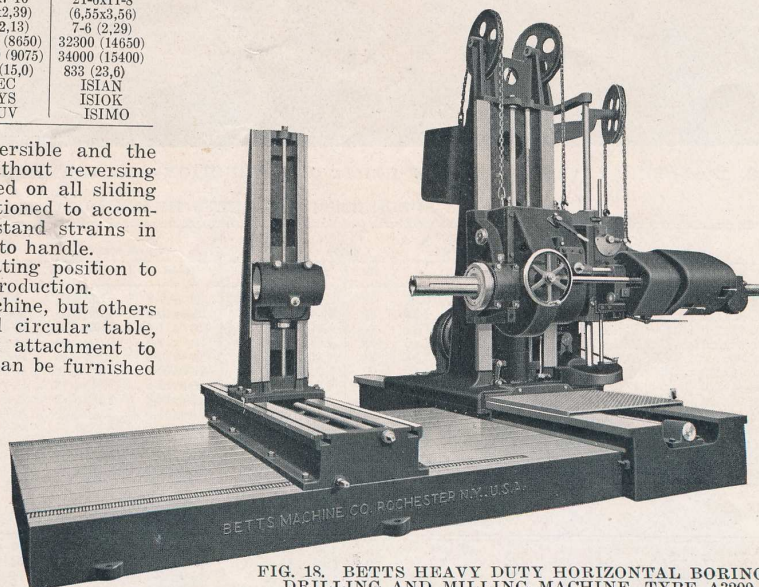


FIG. 18. BETTS HEAVY DUTY HORIZONTAL BORING, DRILLING AND MILLING MACHINE, TYPE A3200

A powerful, accurate machine for the wide range of work found in shipyards and turbine shops. Power feeds in all directions and power rapid traverse make it easy to handle.



**Betts Heavy Duty Planing Machine, Type A4100**

Betts heavy duty planing machines (Figs. 19, 20 and 22) are regularly built for work from 36 in. (914 mm.) square up to 16 ft. (4.88 m.) wide x 12 ft. (3.66 m.) high and of any specified length. They will be furnished to order in larger sizes. Special types, or types modified to meet unusual conditions, can be supplied. Frog and switch planers, locomotive frame planers and cross cutting planers are furnished to meet the demand for single purpose tools on heavy work.

The design of these tools for heavy cuts, and the distribution of metal, have resulted from many years of experience in building machine tools of this character. In shops doing large work, all demands are met by Betts planing machines; railroad shops, locomotive works, shipyards, steel mills, manufacturers of rolling mill equipment and gas

engine builders are included in the list of domestic and foreign users of these tools.

In outline the conventional design of planing machine has been followed, but many important features have been incorporated in the Betts design to increase production and facilitate operation. All the driving gears are cut from steel. The high speed pair is of the herringbone type, which gives a smooth drive. The tables are of box construction, so that no chips can reach the driving gears or vees. The bed has no opening between the ways. In all sizes above 60 in. (1524 mm.) wide, the table is carried on one V and one flat way.

To give greater stiffness, the cross rails are clamped on both sides of each upright. The rail heads are made right and left, so that they can work close together and both heads can cut to the center of the work. Side heads

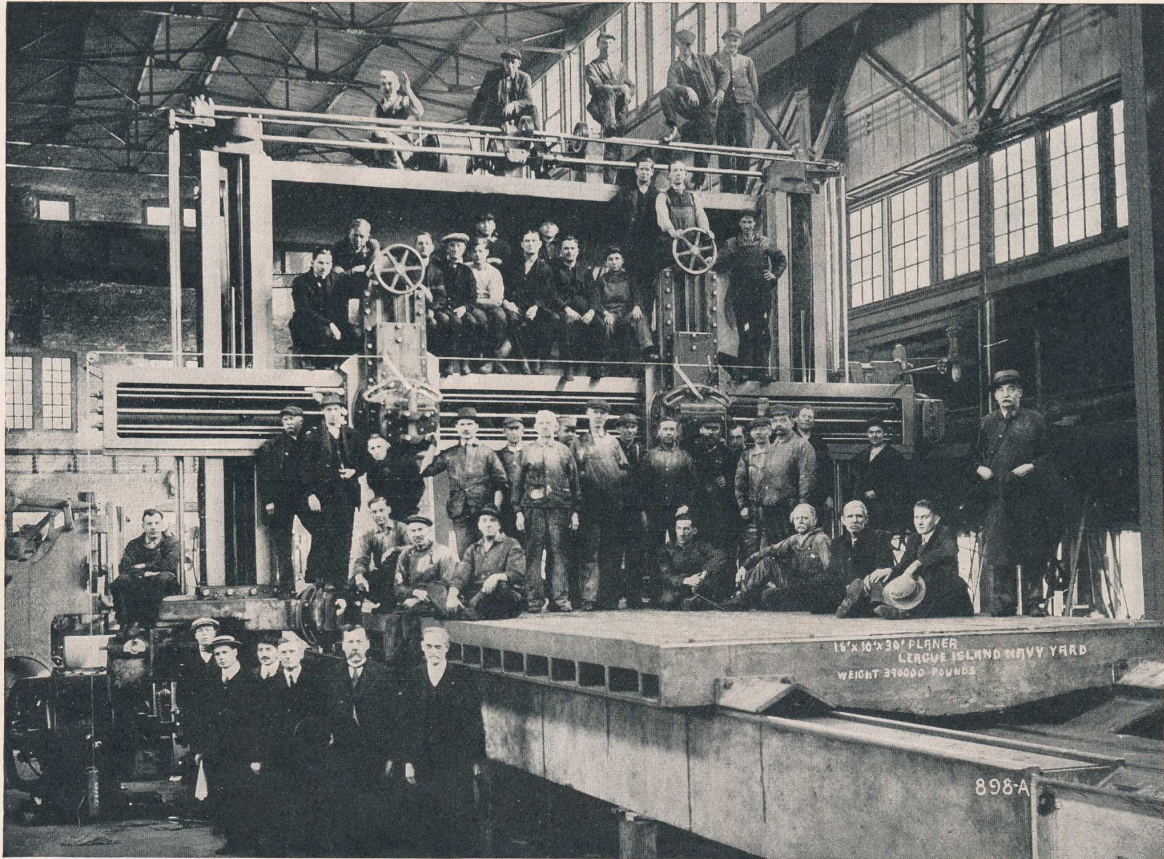


FIG. 19. LARGE PLANING MACHINE UNDER CONSTRUCTION—ILLUSTRATING THE SIZE OF A STANDARD BETTS TOOL

TABLE VIII. SPECIFICATIONS—BETTS HEAVY DUTY PLANING MACHINES, TYPE A4100

Size		Planing width		Planing height		Table width		Motor	Floor space		Height		Shipping volume		CODE WORD		
in.	m.	in.	m.	in.	m.	in.	m.	h.p.	ft.-in.	m.	ft.-in.	m.	cu.ft.	m <sup>3</sup>	Belt drive	Reversing motor drive	Constant speed motor drive
36x 36x 96	0,91x0,91x2,44	37	0,94	37	0,94	31	0,79	20 & 3½	20-6x8-8	6,25x2,64	9-0	2,74	450	12,7	IRARD	IRAX	IRAYO
42x 42x120	1,07x1,07x3,05	43	1,09	43	1,09	36	0,91	20 & 3½	25-0x10-0	7,62x3,05	10-0	3,05	550	15,6	IRBAP	IRBEH	IRBOM
48x 48x120	1,22x1,22x3,05	49	1,25	49	1,25	42	1,07	25 & 3½	26-0x11-6	7,92x3,51	10-6	3,20	644	18,2	IRBSE	IRBUE	IRCAS
54x 54x120	1,37x1,37x3,05	55	1,40	55	1,40	48	1,22	25 & 3½	26-0x12-0	7,92x3,66	11-0	3,35	700	19,8	IRCEK	IRCUA	IRDAV
60x 60x120	1,52x1,52x3,05	61	1,55	61	1,55	54	1,37	35 & 5	26-0x13-6	7,92x3,40	12-6	3,81	875	24,8	IRDEN	IRCUF	IRDOS
72x 72x120	1,83x1,83x3,05	73	1,85	73	1,85	60	1,52	35 & 5	26-0x14-6	7,92x3,42	14-0	4,27	1050	29,7	IRDUG	IREAY	IRECU
84x 84x120	2,13x2,13x3,05	85	2,16	85	2,16	72	1,83	35 & 5	26-0x16-0	7,92x3,88	15-6	4,72	1450	41,0	IREDS	IREFD	IREKE
96x 96x120	2,44x2,44x3,05	98	2,49	98	2,49	84	2,13	50 & 8½	26-0x18-0	8,08x3,49	17-0	5,18	1750	49,5	IREND	IREOV	IREPT
120x120x120	3,05x3,05x3,05	122	3,10	122	3,10	108	2,74	50 & 8½	27-0x21-0	8,23x3,40	20-0	6,10	2700	76,4	IREUB	IRFAB	IRFET
144x120x120	3,66x3,05x3,05	146	3,71	122	3,10	120	3,05	50 & 8½	27-0x23-0	8,23x7,01	20-0	6,10	3100	87,7	IRLOT	IRLUH	IRMAZ
144x144x120	3,66x3,66x3,05	146	3,71	146	3,71	120	3,05	50 & 8½	27-0x23-0	8,23x7,01	22-0	6,71	3150	89,2	IRFIL	IRFOY	IRFUM
168x144x120	4,27x3,66x3,05	170	4,32	146	3,71	138	3,51	75 & 10	27-0x25-0	8,23x7,62	22-0	6,71	3600	101,9	IRGAE	IRGEW	IRGOB
192x144x120	4,88x3,66x3,05	194	4,93	146	3,71	138	3,51	75 & 10	28-0x27-0	8,53x8,23	22-0	6,71	3700	104,7	IRGUP	IRHAH	IRHEZ

TABLE VIII-A. BETTS WIDENED PLANING MACHINES, TYPE A4100

60x 48x120	1,52x1,22x3,05	61	1,55	49	1,25	48	1,22	25 & 3½	26-0x12-6	7,92x3,81	10-6	3,20	800	22,6	IRHIR	IRHUS	IRIAK
72x 60x120	1,83x1,52x3,05	73	1,85	61	1,55	60	1,52	35 & 5	26-0x14-6	7,92x4,42	12-6	3,81	925	26,2	IRIBI	IRIDE	IRIFA
84x 72x120	2,13x1,83x3,05	85	2,16	73	1,85	66	1,68	35 & 5	26-0x15-6	7,92x4,72	14-0	4,27	1200	34,0	IRIGY	IRILO	IRIUU
120x 72x120	3,05x1,83x3,05	122	3,10	73	1,85	72	1,83	35 & 7½	26-0x19-0	7,92x5,79	14-0	4,27	1640	46,4	IRJAN	IRJEF	IRJIX
120x 84x120	3,05x2,13x3,05	122	3,10	85	2,16	78	1,98	35 & 7½	26-0x19-0	7,92x5,79	16-0	4,88	1820	51,5	IRJOK	IRJUY	IRKOT
120x 96x120	3,05x2,44x3,05	122	3,10	98	2,49	90	2,29	50 & 7½	26-0x20-0	8,08x6,10	17-6	5,33	2150	60,8	IRKMO	IRKON	IRLAW



can be applied on either or both uprights. All Betts planing machines are built for four heads. If purchased with less than four, the others can be added at any time.

On planers over 60 in. (1524 mm.) wide, the swiveling side heads are carried on a heavy extension slide (Fig. 21) which permits bringing them far in, close to narrow work.

tion which can be obtained on these machines through its use, power rapid traverse should be specified on all planers.

Reversing motor drive should always be specified where direct current is available. This drive reduces the frictional loss and eliminates all slipping. The convenience of operation tends also to increase production.

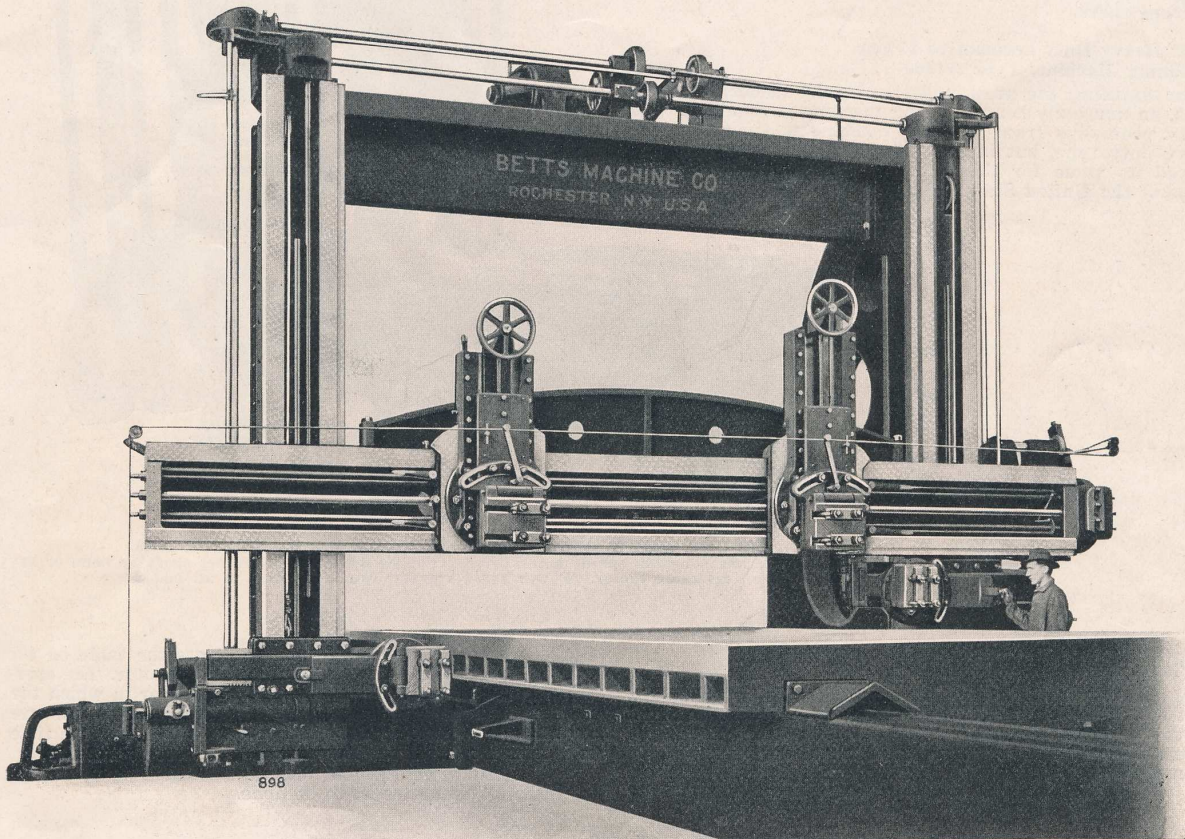


FIG. 20. BETTS HEAVY DUTY PLANING MACHINE, TYPE A4100

Machine is driven by reversing motor. Rail heads and extension slide side heads have power rapid traverse. Automatic relief has been applied to tool apron on rail heads. Bed has closed top.

This slide when extended has an outboard support which consists of a bracket clamped to it and bearing on a finished vertical way. The way extends the height of the upright.

The extension slide can be withdrawn and the bracket removed to admit work up to the capacity of the machine. In no position does it interfere with the feed or rapid traverse of the side heads. The feeds to both rail and side heads are reversible and can be varied from  $\frac{1}{32}$  to  $\frac{3}{4}$  in. (0,04 to 19,05 mm.) for the rail heads and to  $\frac{1}{2}$  in. (12,70 mm.) for the side heads on a minimum table travel.

The feeds are operated independently of one another at either end of the stroke. The cross girt has a wide web which adds greatly to the stiffness of the construction.

All sizes tabulated have the regular equipment which includes two heads on the cross rail. Power rapid traverse at the rate of 6 ft. (1,83 m.) per minute on both the rail heads and the side heads can be applied if ordered with the machine.

The rapid traverse is obtained from a motor or pulley mounted on the cross girt which is used also for raising and lowering the cross rail. Owing to the greater produc-

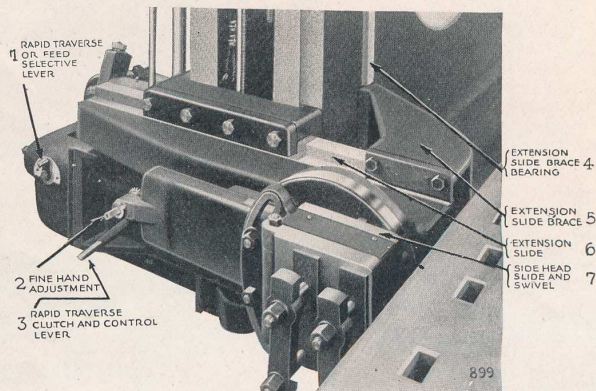


FIG. 21. DETAILS OF BETTS PATENTED EXTENSION SLIDE SIDE HEADS FOR LARGE PLANING MACHINES



If direct current is not obtainable, the other types of motor drive, and several arrangements of belt drive, listed in the code table, can be furnished. Other additions to the regular equipment are tabulated and will themselves indicate when they should be used.

Betts heavy duty planers are built individually; the units are not manufactured in large quantities. Improvements in design are continually being made, and incorporated. Each Betts planer that leaves the shop has passed the Betts tests for accuracy and power, and carries every improvement which has earned the approval of the Betts staff of machine tool engineers.

**Betts Heavy Duty Locomotive Frame  
Planing Machine, Type A4300**

For finishing the steel underframes of modern locomotives, an unusually heavy planing machine is required. The Betts locomotive frame planing machine is similar to the heavy duty type, but is built heavier throughout. It has proved its value for this work in the leading locomotive shops of the United States of America.

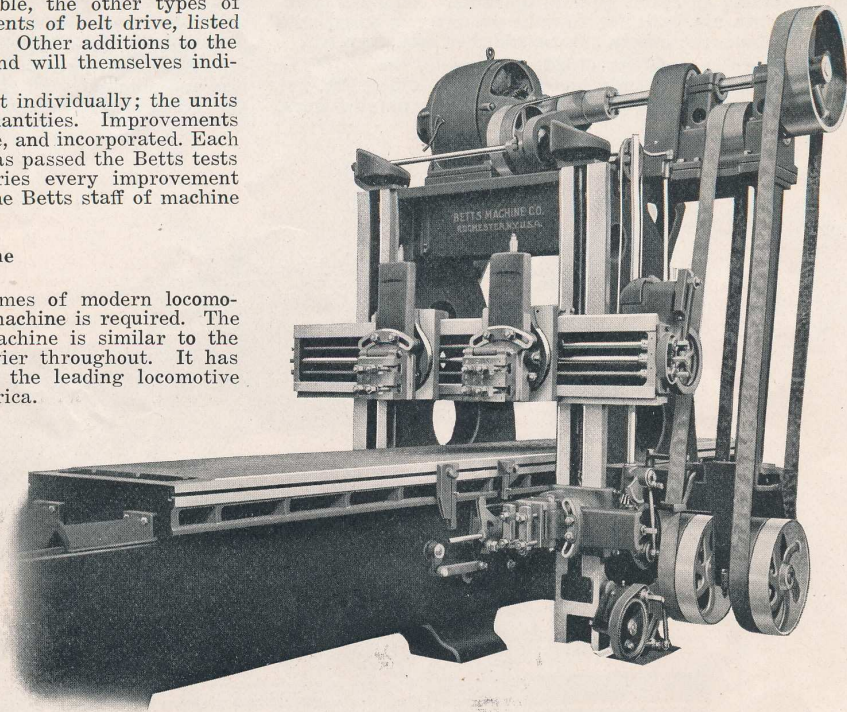


FIG. 22. BETTS HEAVY DUTY PLANING MACHINE, TYPE A4100  
As shown, has constant speed motor drive. Can be driven from counter shaft by belts or by reversing motor. Power rapid traverse can be applied to all heads.

**Betts Heavy Duty Cross Cutting  
Planing Machine, Type A4400**

A cross cutting planing machine (Fig. 23) reduces the cost of machining large pieces which require the finishing of two relatively small flat surfaces far apart, as in the case of sills of steel underframes for railway cars.

In the Betts heavy duty cross cutting planing machine, the work table is fed forward between the cutting strokes

of the tools. The tool heads move across the table on the rail. Each head is driven by an individual motor. The operation is the reverse of the conventional planer in which the tool is fed and the work travels. Speeds and strokes are adjustable. The table has rapid traverse so that little time is lost in moving from one part of the piece to another.

Prices and specifications will be furnished upon receipt of drawings of the work to be done.

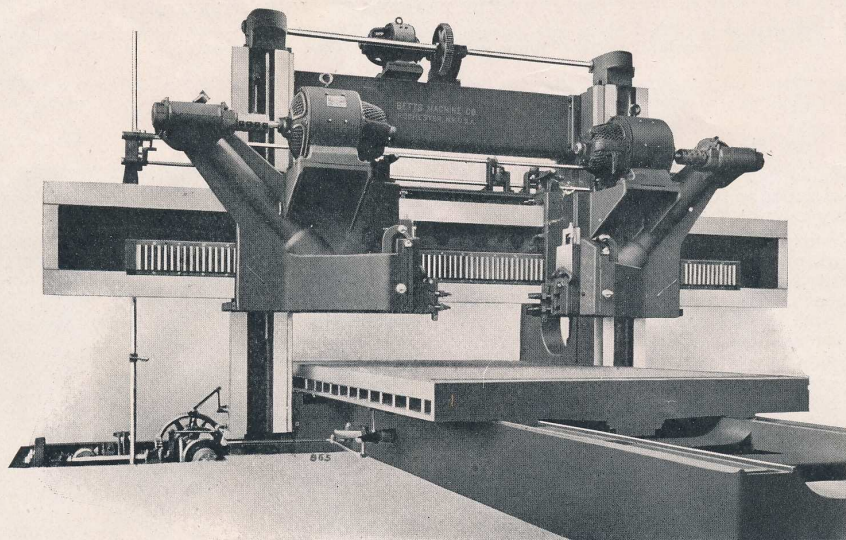


FIG. 23. BETTS HEAVY DUTY CROSS CUTTING PLANING MACHINE, TYPE A4400  
The table feeds while the heads on the rail have the cutting stroke. Power rapid traverse moves finished surface away quickly and brings the next working point into position.



### Betts Heavy Duty Frog and Switch Planing Machines, Type A4200

The severe service required of planing machines when finishing railway frogs and switches has necessitated the development of an unusually heavy, rugged tool. Betts frog and switch planing machines (Fig. 24) contain all the requisite features of the heavy duty planing machines with additional weight and special construction incorporated at the points where experience has indicated the need for changes from the regular design. These changes add materially to the sturdiness of the tools and insure their operation at maximum efficiency on the special classes of work for which they are intended.

Two types of frog and switch planing machines—fixed rail and movable rail—are built, varying from 36 to 48 in. (914 to 1218 mm.) in width, and up to any required planing length. There is no vertical movement of the cross rail on

are the same as for the fixed-rail type except that the clearance height under the tools when they are at their highest position is made to suit the customer's requirements. Inquiries for this type of planer should always specify the maximum height required.

Any tendency of the tool to lift the table is prevented by adjustable gibs running the length of the table. The low stocky upright carries a wide face crossrail which clamps to both sides of each upright and insures a very rigid support for the tool slide. The swiveling rail heads have both cross and angular power feeds.

As in the case of standard Betts planing machines, reversing motor drive is recommended both on account of the positive connection and the decrease in frictional losses due to any form of belt drive. Where direct current is not available the other types of planer drive, open and crossed belt, four belt or constant speed motor through either two

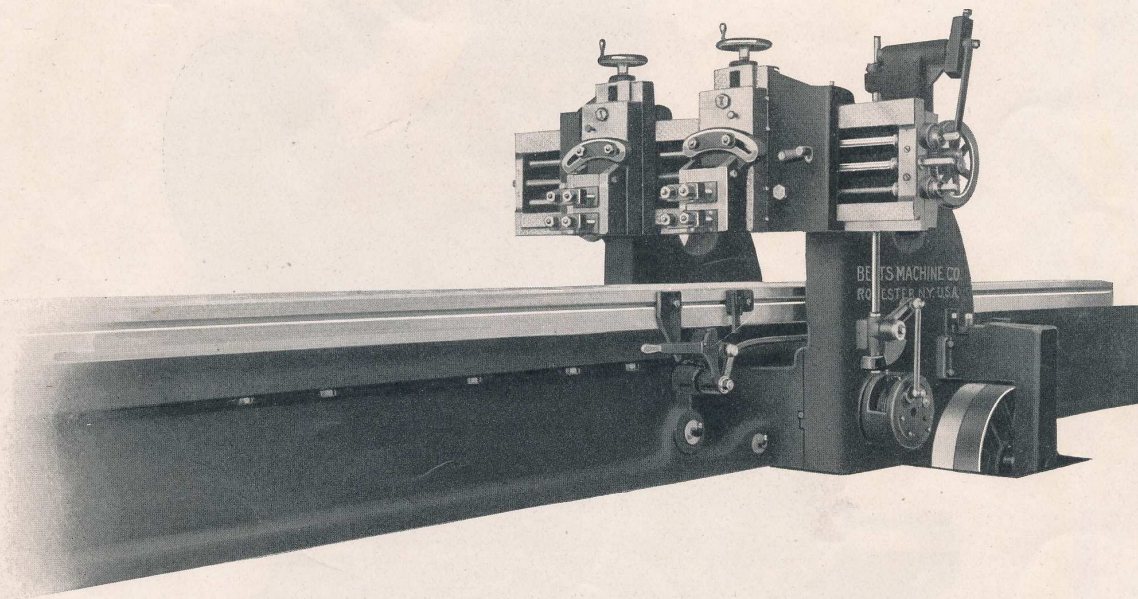


FIG. 24. BETTS HEAVY DUTY FROG AND SWITCH PLANING MACHINE, TYPE A4200  
Built for the heaviest cuts that modern cutting tools will stand when working on tough and hard steel.

the fixed rail type of machine. The rail is built at a height from the table sufficient to accommodate any work for which the machine is intended. The tool slide is provided with ample travel to finish any work within the tool's capacity. The drive is simple and powerful.

The bed is cast with the top solid so that no chips can reach the driving gears. In order to give a smooth drive the first or high speed pair of gears is of the herringbone type. All driving gears and the table rack are of steel.

The table is cast solid. The tee slots or stop holes, whichever the customer specifies, are machined from the solid metal.

Feeds are of the same type as the Betts heavy duty planing machine and equal attention has been given to producing a machine economical and efficient in operation, with productive possibilities limited only by the quality of the cutting steel employed.

The movable rail type has all the features of the fixed rail machine but is better suited to shops where the height of work may vary considerably. On the movable-rail machines provision is made for adjustment of the rail height either by hand or power—usually by power. The dimensions of the movable-rail frog and switch planing machines

or four belts can be provided for if specified at the time order is placed.

TABLE IX. BETTS HEAVY DUTY FIXED-RAIL FROG AND SWITCH PLANING MACHINE, TYPE A4200

(1) Size.....in. (mm.)	36x18x120 (914x457x3048)	42x18x120 (1067x457x3048)	48x18x120 (1219x457x3048)
(2) Planing width.....in. (mm.)	37 (940)	43 (1092)	49 (1245)
(3) Planing height.....in. (mm.)	19 (483)	19 (483)	19 (483)
(4) Table width.....in. (mm.)	31 (787)	36 (914)	42 (1067)
(5) Motor required.....h. p.	50	50	50
(6) Length of machine.....ft.-in. (m.)	25-0 (7.62)	25-0 (7.62)	25-0 (7.62)
(7) Width of machine.....ft.-in. (m.)	9-0 (2.74)	9-6 (2.90)	10-0 (3.05)
(8) Height of machine.....ft.-in. (m.)	7-0 (2.13)	7-0 (2.13)	7-0 (2.13)
(9) Shipping volume.....cu. ft. (m <sup>3</sup> )	500 (14.2)	600 (17.0)	675 (19.1)
(10) Code word: Belt drive.....	IRMER	IRMYE	IRNEU
(11) Constant speed motor drive.....	IRMUH	IRNBA	IRNUN
(12) Variable speed motor drive.....	IRMOW	IRNAC	IRNOZ

The unusually large production in many industries of medium sized steel castings requires a very powerful planing machine without the height of the Betts heavy duty type. For work within its capacity, the rigid, low, Betts heavy duty frog and switch planing machine meets these requirements.



### Betts Heavy Duty Slotting Machine, Type A5100

Betts heavy duty slotting machines (Fig. 25) are all crank driven. Sizes range from the small tool with 6 in. (152 mm.) stroke to the massive slotting machine with 30 in. (914 mm.) tool travel.

They are among the most adaptable of all the tools in a shop. A great variety of work now done on other tools can be handled economically on slotting machines.

The frames of Betts heavy duty slotting machines have the greatest cross section at the point of greatest stress. In the larger sizes, the ram guide is adjustable vertically and can be brought down close to the work to support the

ram. On all sizes, a spring relief apron carries the cutting tool. Saddle, cross table and circular table feeds are reversible.

The operator controls the feeds from his normal position at the side of the table whence he can easily watch the cutting tool. Four types of drive can be supplied: cone pulley, single pulley through four speed gear box, constant speed motor through gear box, and variable speed motor. On motor driven machines, the driving motor is mounted on the far side of the frame, out of the way of the operator and crane.

Easy operation is obtained without any sacrifice of rigidity or strength. Betts heavy duty slotting machines maintain their accuracy under heavy cuts. Their centralized control increases production.

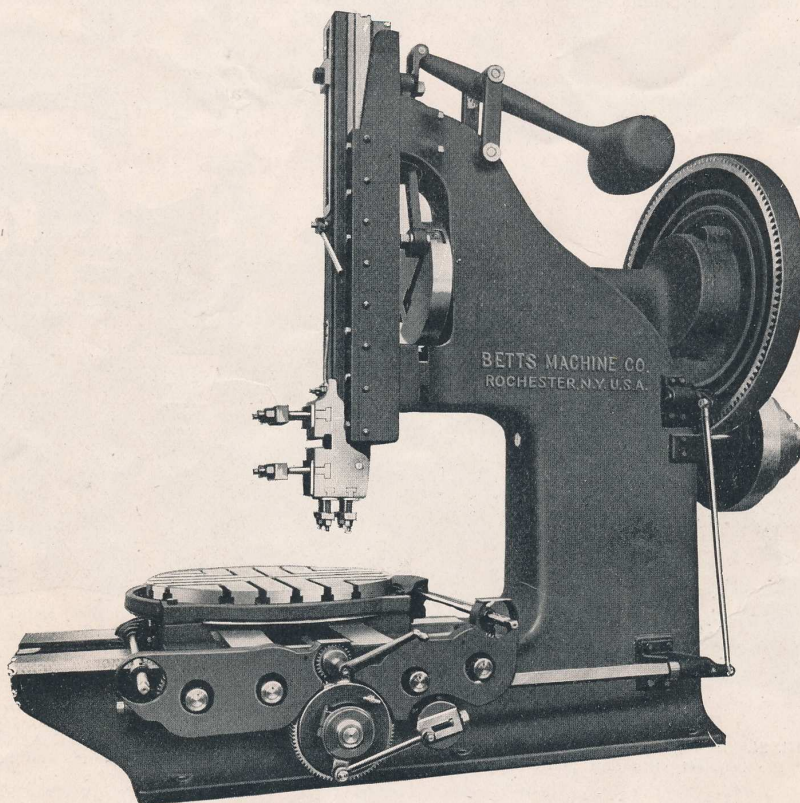


FIG. 25. BETTS HEAVY DUTY SLOTTING MACHINES, TYPE A5100

Control of the work is concentrated at the end of the saddle in the operator's normal working position. A stiff, powerful tool for general shop use.

TABLE X. BETTS HEAVY DUTY SLOTTING MACHINES

(1)	Fixed guide		Adjustable guide													
(2) Size.....in. (mm.)	6 (152)	8 (203)	10 (254)	12 (305)	14 (356)	16 (406)	18 (457)	20 (508)	22 (559)	24 (610)	26 (660)	28 (711)	30 (762)			
(3) Actual stroke in. (mm.)	6½ (165)	8½ (216)	10½ (267)	12¾ (324)	14¾ (375)	16¾ (425)	18¾ (476)	20¾ (527)	22¾ (578)	24¾ (629)	26¾ (679)	28¾ (730)	30¾ (781)			
(4) Will slot to center of.....in. (mm.)	30 (762)	36 (914)	42 (1067)	54 (1372)	54 (1372)	70 (1778)	85 (2159)	85 (2159)	94 (2388)	100 (2540)	100 (2540)	100 (2540)	100 (2540)			
(5) Height from table to frame.....in. (mm.)	11 (279)	13 (330)	15 (381)	17½ (445)	17½ (445)	22½ (572)	30 (762)	30 (762)	30 (762)	36 (914)	36 (914)	36 (914)	42 (1067)			
(6) Cross travel in. (mm.)	14 (356)	17 (432)	20 (508)	24 (610)	24 (610)	30 (672)	36 (914)	36 (914)	44 (1118)	48 (1219)	48 (1219)	48 (1219)	48 (1219)			
(7) Longitudinal travel in. (mm.)	11 (279)	20 (508)	25 (635)	30 (762)	30 (762)	38 (965)	42 (1067)	42 (1067)	48 (1219)	52 (1321)	52 (1321)	52 (1321)	64 (1626)			
(8) Table diameter in. (mm.)	18 (457)	21½ (546)	25½ (648)	29½ (749)	29½ (749)	32 (813)	41 (1041)	41 (1041)	47 (1194)	54 (1372)	54 (1372)	54 (1372)	54 (1372)			
(9) Motor required h.p.	2½	3½	3½	5	5	7½	7½	10	10	10	10	10	10			
(10) Floor space.....ft.-in.	5-6x4-0	7-2x4-0	9-0x4-1	10-4x5-9	10-4x5-9	11-4x6-2	14-2x8-0	14-2x8-2	16-0x9-2	17-0x10-2	17-0x10-2	17-0x10-2	17-6x10-6			
(11) Height.....ft.-in. (m.)	(1,68x1,22)	(2,18x1,22)	(2,74x1,24)	(3,15x1,75)	(3,15x1,75)	(3,45x1,88)	(4,32x2,44)	(4,32x2,44)	(4,88x2,80)	(5,18x3,10)	(5,18x3,10)	(5,18x3,10)	(5,33x3,20)			
(12) Volume, boxed for export cu. ft. (m³)	7-6 (2,29)	8-0 (2,44)	8-6 (2,59)	10-4 (3,15)	10-8 (3,25)	12-0 (3,66)	13-4 (4,06)	13-6 (4,11)	13-8 (4,17)	16-6 (5,03)	16-6 (5,03)	16-6 (5,03)	19-2 (5,84)			
(13) Code word:	152 (4,3)	220 (6,2)	325 (9,2)	356 (10,1)	364 (10,3)	460 (13,0)	723 (22,2)	731 (23,2)	870 (24,6)	998 (28,0)	1010 (28,6)	1020 (28,8)	1100 (31,1)			
Belt drive.....	COHLU	COHPE	COIKS	COJNU	COJUA	COKAS	COKFI	COKKY	COKYU	COLIF	COLUG	COMAY	COMKE			
Constant speed motor drive.....	COHOG	COHXX	COJIZ	COJSE	COJXU	COKEK	COKJA	COKUD	COLBO	COLOS	COLXA	COMCO	COMUB			
Variable speed motor drive.....	COHNI	COHRA	COJEH	COJOM	COJYV	COKCO	COKIC	COKOP	COLAY	COLND	COLVE	COMCU	COMOY			



### Betts Heavy Duty and Extra Heavy Car Wheel Boring Machine, Type A6100

The Betts 52 in. (1321 mm.) heavy duty car wheel boring and facing machine (Fig. 26) is designed and built to give a large output when boring and facing coach, truck, and locomotive trailer wheels of cast iron or steel. It is used in all of the leading railroad shops, car wheel plants and machine shops, where rapid production combined with accuracy in boring and facing wheels is essential.

It will handle wheels from 10 to 42 in. (254 to 1067 mm.) in diameter on the tread.

The table is driven by accurately cut bevel gear and steel pinion from belt or motor, to suit requirements. It is fitted with a self-centering universal five-jaw chuck operated by a single motion of a cam lever that gives sufficient movement for firmly gripping the wheel.

The boring spindle is of large diameter, travels in very long bearing, is counterbalanced and has sufficient travel to use long bars. The hub facing attachment consists of a horizontal spindle of large diameter which carries a tool slide with a vertical hand adjustment. A square guide sliding on a bearing on the underside of the frame prevents the facing spindle from yielding under heavy cuts. The facing spindle has ample travel so that it can be moved out of the way when chucking the largest wheels.

A wide range of feeds, as well as rapid hand movement, is provided for both boring bar and hub facing spindle. For handling the wheels to and from the table, the machine is equipped with a pneumatic crane or with a drum type crane.

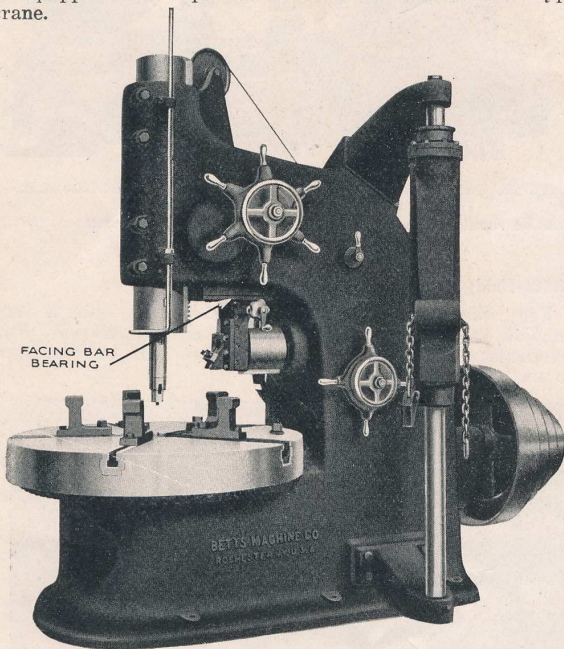


FIG. 26. BETTS HEAVY DUTY CAR WHEEL BORING MACHINE. TYPE A6100

A simple rugged tool which gives a high output on all work within its capacity.

Centralized control for speed and feed changes, and for operating the crane, increases production.

An extra heavy and powerful car wheel boring machine is made for shops specializing in car wheel work.

Specifications will be supplied upon receipt of details of the work to be done, together with the production desired.

TABLE XI. BETTS HEAVY DUTY AND EXTRA HEAVY CAR WHEEL BORING AND FACING MACHINES, TYPE A6100

(1)	Heavy duty	Extra heavy
(2) Maximum swing.....in. (mm.)	52 (1321)	52 (1321)
(3) Wheels handled: Largest.....in. (mm.)	42 (1067)	42 (1067)
(4)                   Smallest.....in. (mm.)	10 (254)	10 (254)
(5) Motor required.....h.p.	15	50
(6) Length of machine.....ft.-in. (m.)	12-6 (3.81)	15-0 (4.57)
(7) Width of machine.....ft.-in. (m.)	7-6 (2.29)	9-4 (2.90)
(8) Height of machine.....ft.-in. (m.)	9-6 (2.90)	12-0 (3.66)
(9) Shipping volume.....cu. ft. (m <sup>3</sup> )	375 (10.6)	550 (15.6)
(10) Code word: Belt drive.....	CUFJA	CUGNU
(11)           Constant speed motor drive.....	CUFOP	CUGUG
(12)           Variable speed motor drive.....	CUFKY	CUGOS

### Betts Heavy Duty Multiple Spindle Continuous Milling Machine, Type A8100

The Betts multiple spindle, rapid production, continuous vertical milling machine (Fig. 27) is usually built with three spindles, but can be furnished with more. Of simple design, rigid and accurate, it can be used to great advantage wherever rapid production heavy milling of a large number of similar parts is desired.

The spindles are made of special hammered steel and are driven through long splines from spur gears. The drive comes through worm and worm wheels from belt or motor. Each spindle carries a milling cutter and can be adjusted vertically by hand.

The table, fitted with a split taper bushing for taking up wear, revolves around the column. It is supported on a flat bearing on the bed and is automatically lubricated. The table is driven through a large internal gear. Four continuous feeds are obtained through sliding steel gears, worm, and worm wheel. All bearings are bronze bushed and all gears run in a bath of oil. At no time are there any gears in mesh except those actually transmitting power.

Fixtures suitable for the class of work to be done, are mounted on the continuously revolving table. No time is lost in chucking, as the work is changed while the fixtures pass from one cutter to the next. The machine will do, ordinarily, as much work as can be handled by two men.

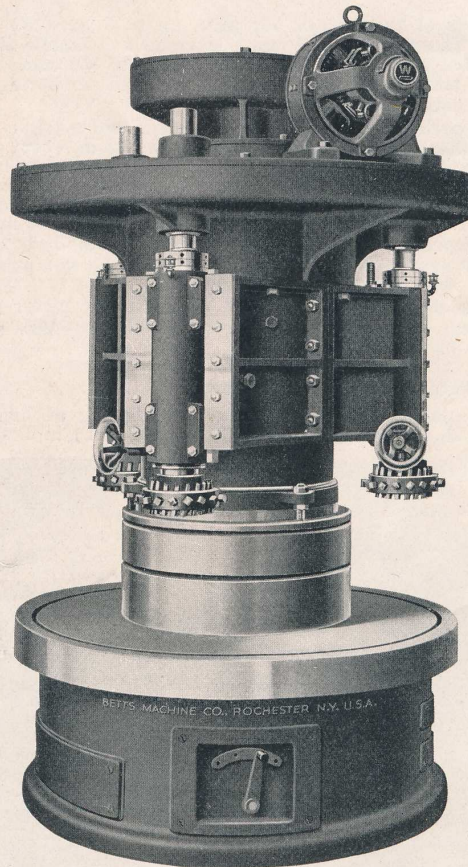


FIG. 27. BETTS HEAVY DUTY VERTICAL CONTINUOUS MILLING MACHINE, TYPE A8100

When equipped with jigs, will keep two men busy changing the work. Specially suitable for heavy jobs such as journal boxes.

TABLE XII. BETTS HEAVY DUTY MULTIPLE SPINDLE CONTINUOUS MILLING MACHINE, TYPE A8100

(1) Diameter of table.....	60 in. (1524 mm.)
(2) Maximum distance table to cutter.....	21 in. (533 mm.)
(3) Maximum diameter of cutter.....	16 in. (406 mm.)
(4) Motor required.....	10 h.p.
(5) Diameter of machine.....	9 ft. 6 in. (2.90 m.)
(6) Height of machine.....	9 ft. 6 in. (2.90 m.)
(7) Shipping volume.....	400 cu. ft. (11.3 m <sup>3</sup> )
(8) Code word: Belt drive.....	CUGVE
(9)           Constant speed motor drive.....	CUHAY
(10)           Variable speed motor drive.....	CUQXA



### Betts-Bridgeford Gun Boring and Turning Lathes, Type A9100

The demand for heavy guns in large quantities during 1914-1918, necessitated the development of lathes for finishing at a high production rate the outside and inside of gun tubes and sleeves.

Two sizes of gun boring lathes (Fig. 28) similar to the Betts-Bridgeford type of geared head engine lathe have been developed. The 39 in. (991 mm.) machine will handle

an unusually heavy plain turning machine (Fig. 29) was developed. This lathe is driven through single pulley and three speed change gears to the spindle. Four mechanical feed changes are supplied for turning shells.

This lathe is equipped with two carriages, one for turning the straight diameter, the other with radius or profile attachment for finishing the nose of the shells.

For boring shells spindle is equipped with a heavy pot chuck to hold shell and with special carriage for holding and feeding boring bar on which cutter head is mounted.

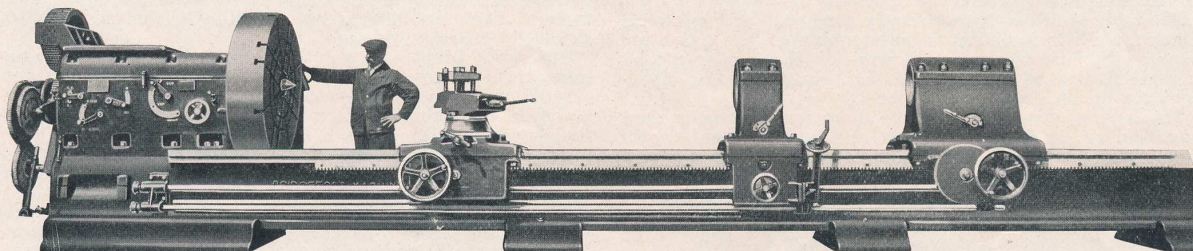


FIG. 28. BETTS-BRIDGEFORD HEAVY DUTY GUN BORING AND TURNING LATHE, TYPE A9100  
Suited for turning and boring, simultaneously, gun forgings, propeller shafts, etc. Shown arranged for motor drive without motor.

all parts of the barrels for guns up to 6 in. (152 mm.) bore. The 48 in. (1219 mm.) machine will handle similar parts for guns from 6 to 10 in. (152 to 254 mm.) bore. Either machine can be furnished arranged for boring only or for both boring and turning.

Gun boring lathe beds have flat ways and a triple back-geared head-stock similar to that on the 42 in. (1067 mm.) and 48 in. (1219 mm.) heavy duty screw cutting lathes. Feed is applied to the boring bar carriage by a bronze nut engaging a large diameter lead screw supported on bearings in center of bed. Feed to the turning carriages is applied through a separate feed screw at front of lathe bed. Power rapid traverse is furnished for both boring carriage and turning carriage.

These machines are supplied arranged for motor drive, with two steady rests for the work and two supports for the boring bar.

### Shell Turning and Boring Lathes

For rough and finish turning and boring of high explosive shells from 6 to 12 in. (152 to 305 mm.) in diameter,

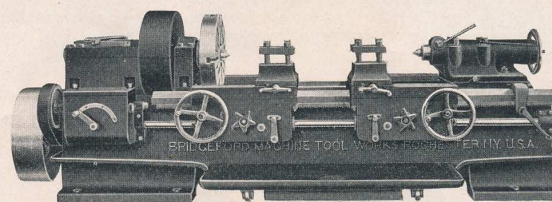


FIG. 29. BETTS-BRIDGEFORD HEAVY DUTY SHELL TURNING LATHE, TYPE A9300  
Can be furnished with a heavy boring carriage for internal rough and finish boring.

### Betts-Bridgeford Rifling Machines

For rifling guns up to 10 in. (254 mm.) bore a very efficient type of rifling machine has been developed. Full particulars in regard to this machine will be furnished to anyone interested.

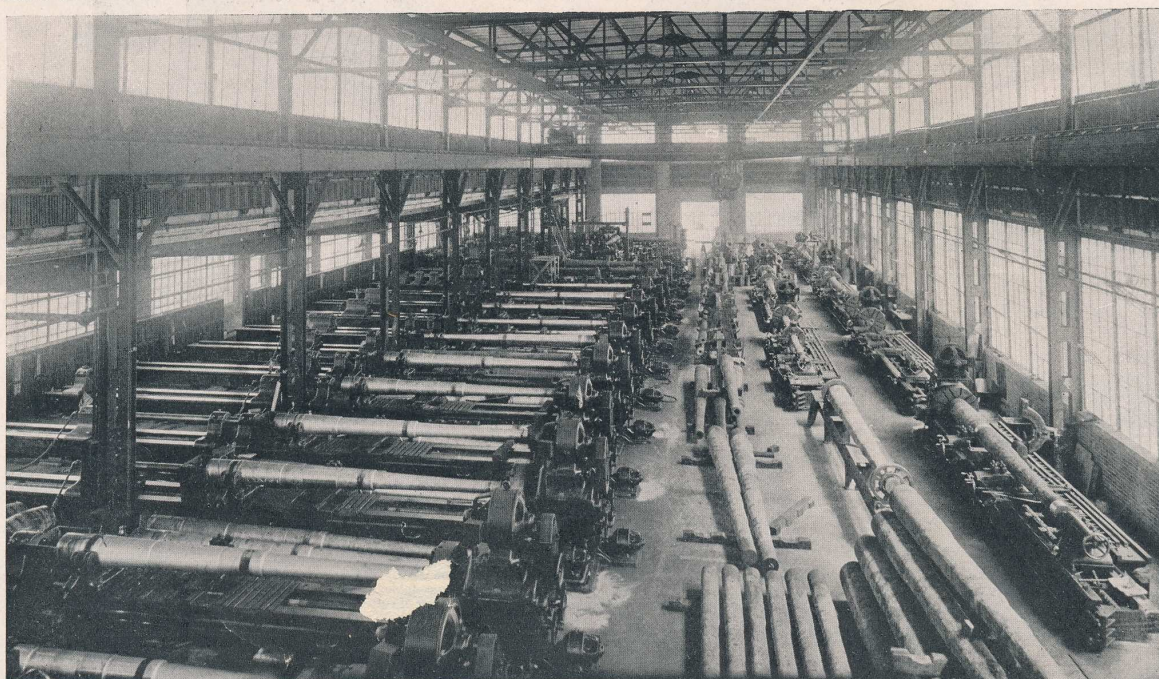


FIG. 30. A MODERN GUN PLANT COMPLETELY EQUIPPED WITH BETTS-BRIDGEFORD HEAVY DUTY TOOLS



# INGLE MACHINE COMPANY

Cable Address  
"INGLECO" Rochester  
Iron Age Code on page 8

ROCHESTER, N. Y., U.S.A.

Other Codes Used  
General Telegraph, Lieber's  
Western Union

## Manufacturers of Gear Tooth Rounding Machines

### Products

#### GEAR TOOTH ROUNDING MACHINES

##### "Rochester" Gear Tooth Rounding Machine

This is a semi-automatic machine for rounding or champfering the ends of teeth on sliding spur gears or on bevel gears such as are used in automobile transmissions, machine tools and special machinery. It will automatically round the teeth of any gear, including internal gears, within its rated capacity, regardless of pitch or number of teeth.

The design of this machine and arrangement of parts is such as to insure maximum speed in operation and production. All parts are easy of access and can, therefore, be properly cared for without waste of time. The base of the machine is arranged to occupy a minimum of floor space and contains an oil reservoir with direct-connected oil pump and a cabinet, with hinged door, in which accessories can be stored. A three-step cone pulley provides three feeds to allow for variation in material and pitch of gears to be rounded.



TRADE MARK

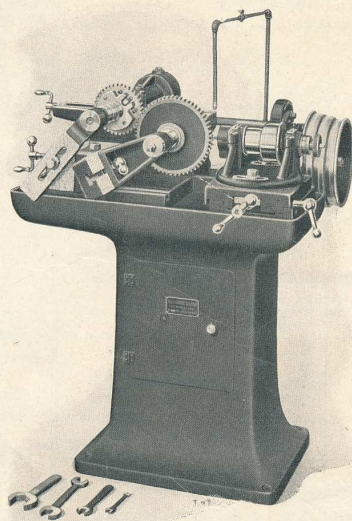


FIG. 1. "ROCHESTER" GEAR TOOTH ROUNDING MACHINE

The standard cam furnished with the machine provides for three contours of rounded teeth. A sharp point, a perfect half round or a flat point can be obtained. The cutter is held in a spring collet chuck in the spindle. The spindle is mounted in special bronze bearings of ample size. The work or gear, the teeth of which are to be rounded, is mounted on the work arbor and meshes directly with an index gear. Drive is from a countershaft which runs at constant speed, through two belts, one to the cutter spindle pulley, the other to the feed cone pulley.

A special feature in the design and construction of this machine is the method of feeding the work. All spur gears and pinions to be rounded mesh with a chrome nickel steel master gear. The rotation of this master gear is continuous, thus saving the time which would be necessary to index the work for each tooth. A separate master gear of a given pitch will fit all gears of the same pitch regardless of the number of teeth.

Another feature of importance is that the machine is automatic in operation and requires only to be loaded and unloaded; skilled labor is not required; one operator can easily handle two or more machines, as the cutting operation stops automatically when the gear is finished.

An internal attachment is required for rounding the teeth of internal gears, and centering attachment for rounding the teeth of gears solid on shafts.

One master gear of any desired pitch is furnished as standard equipment with each machine, and additional master gears are extra equipment supplied on order. Special fixtures for holding ring gears, or special shapes, are extra attachments and if required should be ordered with the machine.

The very fact of modern quantity manufacturing implies automatic machine operations. The advantage of this machine lies in its capacity for eliminating hand work in finishing the teeth of any gear requiring rounding or champfering on the ends of the teeth. It is practical and efficient, well known for its productive capacity, durability and simplicity of design. It is thoroughly practical for large or small plants and will pay for itself in a short time if there is sufficient volume of work to keep it moderately busy.

This machine is the fastest means known for rounding the teeth of gears, and the finished work is uniformly accurate. It has become so well and so favorably known among large manufacturers, automobile plants and producers of gears, that hundreds of representative manufacturers all over the world have adopted "Rochester" gear tooth rounding machines as standard equipment for this class of work.

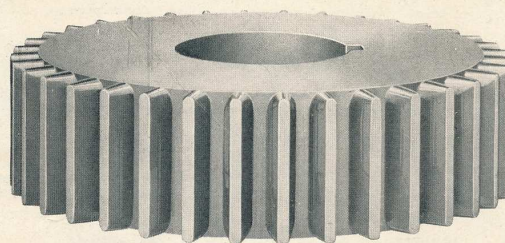


FIG. 2. SHOWS THE EXCELLENT WORK DONE BY "ROCHESTER" MACHINES

**STANDARD EQUIPMENT**—Includes: Oil pump and oil reservoir, pump fittings, two double-end cutters, arbor, countershaft complete, one master gear of any specified pitch, and necessary wrenches. Code words for extra attachments: Internal attachment, 12 in. (305 mm.) COYAL; 30 in. (762 mm.) BRIAR; Centering attachment, 12 in. (305 mm.) BRINE.

TABLE I. SPECIFICATIONS—"ROCHESTER" GEAR TOOTH ROUNDING MACHINES

(1) Type	12 in. (305 mm.)	20 in. (508 mm.)	30 in. (762 mm.)
(2) Capacity: Max. diameter in. (mm.)	12 (305)	20 (508)	30 (762)
(3) Min. diameter in. (mm.)	1½ (38)	3 (76)	3 (76)
(4) Size of tooth diameter/pitch <sup>1</sup> (module) in. (mm.)	12 to 4 (2 to 6)	12 to 3 (2 to 8)	12 to 2 (2 to 12)
(5) Cutter speeds..... r.p.m.	2830-3730	2830-3730	2830-3730
(6) Production—teeth rounded per min.	40-52-67	40-52-67	40-52-67
(7) Floor space..... ft.-in. (m.)	2-3x2-0 (0.7x0.6)	2-3x2-0 (0.8x0.6)	4-0x2-6 (1.2x0.8)
(8) Total height..... in. (m.)	50 (1.3)	64 (1.6)	58 (1.5)
(9) Countershaft..... in. (m.)	800	800	800
(10) Weight: Net.....	1080 (490)	1420 (645)	1740 (790)
(11) Boxed for export lb. (kg.)	1340 (610)	1680 (762)	1980 (900)
(12) Volume, boxed for export cu. ft. (m <sup>3</sup> )	45 (1.3)	52 (1.5)	60 (1.7)
(13) Code word: Spur gears.....	CLYDE	SODUS	LOGAN
(14) Bevel gears.....	FARGO	CADIZ	ODELL

<sup>1</sup>Diametral pitch = number of teeth per inch of pitch diameter.

<sup>2</sup>Module = pitch diameter in mm.  
number of teeth in gear.



TABLE XIII. CODE WORD FOR ATTACHMENTS		TABLA XIII. CLAVE PARA DIS- POSITIVOS		TABELLA XIII. PALAV- RAS DO CODIGO PARA PEÇAS DE SOBRESA- LENTE		TABLE XIII. MOTS DE CODE POUR ACCESSOIRES	
Code Words	LATHES	TORNOS	TORNOS	TORNOS	TOURS	TABLE XIV.	
CUIWY CUIWZ CUXAU CUXEM CUXGI CUXKA CUXOR CUXTH CUXZE CUZAA CUZBY CUZDU CUZES CUZGO CUZIK	Quick change gears Taper attachment Full swing rest Follower rest Thread indicator Rapid traverse Attach motor Apron control 11 in. center rest 18 in. center rest 19 in. center rest 24 in. center rest Fit chuck and plate Metric lead screw Metric transposing gears	Engranajes de cambios rápidos Dispositivo para trabajos cónicos Luneta para el mayor diámetro Luneta móvil Indicador para fileteado Movimiento transversal rápido Agrése el motor Gobierno del mecanismo del carro Luneta central de 0.28 m. Luneta central de 0.46 m. Luneta central de 0.48 m. Luneta central de 0.61 m. Ajustese mandril y plato Tornillo de paso métrico Engranaje para paso métrico	Engrenagens de mudança rápida Dispositivo para tornear cônicos Luneta para o maior diametro Luneta movel Indicador das roscas Movimento transversal rapido Instale motor Comando do carro da espera Luneta central 0.28 Luneta central 0.46 Luneta central 0.48 Luneta central 0.61 Buchas de ajuste e placas Parafusos de passos metricos Engrenagens para passos metricos	Engrenages pour ch. de vit. rapide Appareil à tourner cône Lunette de diamètre tournable max. Lunette à suivre Indicateur de filetage Avance transv. à retour rapide Commande pour moteur Contrôle du mécanisme du tablier Lunette de 0.28 m. Lunette de 0.46 m. Lunette de 0.48 m. Lunette de 0.61 m. Mandrin et plateau Vis-mère à pas métrique Engrenages pour réduire au pas métrique	LATHES TORNOS TORNOS TOURS  Length of bed Largo de bancada Comprimento do barramento Longueur du banc		
VERTICAL BORING AND TURNING MILLS		MAQUINAS VERTICALES DE TORNEAR Y MANDRILAR		TORNOS VERTICAES DE MANDRILAR E TORNEAR		MACHINES VERTICALES A ALESER ET A TOURNER	
ISMAL ISMEU  ISMOZ ISMUN  ISNAF ISNEX ISNIP ISNOC ISOKO ISOOF ISOUT ISPAL ISPIV ISPUW	Side heads Thread cutting and scoring at- tachment Extra pitches Thread chasing attachment, right hand Boring head, revolving Steel spindles Extra spindle travel Fine feeds Hexagon turret Crowning attachment Slotting attachment 12 in. jaws fitted 12 in. additional height under tools 24 in. ditto	Cabezal para trabajos de costado Dispositivo indicador y cortador de filetes Avances adicionales Peine para filetear a derechas  Cabezal giratorio de mandrilar Husillo de acero Avance adicional del husillo Avance de afinar Revolver hexagonal Dispositivo de tornear curvo Mortajador Colóquese mordazas de 0.30 m Altura adicional debajo de la herramienta, 0.30 m. Idem anterior de 0.60 m.	Cabeçotes laterais Apparelho abridor e marcador de roscas  Passos extras Apparelho para atarrachar, mão direita Cabeçote para brocar, giratorio Arvores de aço Avanços extras das arvores Avanços precisos Espera revolver hexagonal Apparelho para tornear curvo Entalhador Castanhas ajustadas 0.30 Altura adicional sob os ferros 0.30 Idem 0.60	Poupeés Auxiliaires Appareil à fileter et à débiter  Pas supplémentaires Peignes à fileter à droite Poupeé à aléser, pivotante Broches en acier Mouvement transversal supplémentaire Avances de précision Tourelle hexagonale Accessoires pour tourner courbe Accessoires pour mortaiser Pourvu de mâchoires de 0.30 m. Hauteur supplémentaire au-dessous de l'outil de 0.30 m Idem de 0.60 m	ft. m. Code word		
HORIZONTAL BORING AND DRILLING MACHINES		MAQUINAS HORIZONTALES DE MANDRILAR Y PERFORAR		TORNOS HORIZONTAES PARA BROCAR, E FURAR		MACHINES HORIZONTALES A PERCER ET A ALESER	
ISIP ISIRE  ISITA  ISIWU ISTAT	Circular table—hand feed Power cross and longitudinal feed Ditto, plus power circular feed  Thread cutting attachment Extra facing heads	Mesa circular, avances a mano Avances en cruz y longitudinal automáticos Avances en cruz, longitudinal y circular, automáticos Dispositivo de filetear Cabezales extras de refrentar	Placa circular, avanço manual Avanço motriz, transversal e longi- tudinal Avanço motriz, transversal, longi- tudinal e circular Apparelho para abrir roscas Cabeçote extra de facear	Table circulaire—avance à la main Avance transversale et longitudinale, automatiques Les trois avances, longie, transvle et cir- culaire, automatiques Dispositif à fileter Plateaux supplémentaires à dresser	ft. m. Code word		
HORIZONTAL BORING, DRILLING AND MILLING MACHINES—FLOOR BORER		MAQUINAS HORIZONTALES DE FRESAR, PERFORAR Y MANDRILAR—BANCA DE PISO		MACHINAS HORIZONTAES PARA BROCAR, FURAR E FRESAR—TIPO DE SOALHOS		MACHINES HORIZONTALES A ALESER, A PERCER ET A FRAISER—PERCEUSE RADIALE	
ISKUH  ISLAZ ISLER ISLOW ISLUK ISLYE	12 in. extra saddle travel  Extra column travel Extra sq. ft. table 6 in. spindle Omit floor plate Thread cutting attachment	Recorrido extra del carro soporte 305 mm. Recorrido extra de la columna Agréguese un pie de bancada Husillo de 0.15 m. Omitase la placa de piso Dispositivo de filetear	Avanço extra do carro da espera 305 mm. Avanço extra da columna Pés quadrados extras das placas Arvore 0.15 Omitte-se a placa do chão Apparelho para abrir roscas	Mouvement supplémentaire du porte- outils 305 mm. Mouvement vertical supplémentaire Table supplémentaire Broche de 0.15 m. Supprimer la plaque de base Appareil à fileter	ft. m. Code word		
PLANING MACHINES		MAQUINAS CEPILLADORAS		PLAINAS		MACHINES A RABOTER	
IRXAD IRXEV  IRXOA  IRXUO  IRYAG  IRYBE IRYDA IRYGU  IRYJO IRLYK  IRYUR IRZAJ IRZEB IRZIT  IRZOG IRZRA  ISAAP  ISAEH	4 belt drive Gear box drive  Power angular feed to side head  Including variable speed motor  Including constant speed motor  Including reversing motor Power rapid traverse to side heads Power rapid traverse to rail heads  Forced lubrications to table tracks Forced lubrication to table tracks and driving gears Side head (right) Side head (left) Two side heads Two belt right angle drive  4 belt right angle drive 2 belt parallel drive  4 belt parallel drive  Attach motor	Transmisión de 4 correas Transmisión por cajas de en- granajes Transmisión angular para el cabezal del costado Incluso motor de velocidad vari- able Incluso motor de velocidad const- ante Incluso motor reversible Avance transversal rápido para los cabezales del costado Avance transversal rápido para los cabezales del frente  Lubricación forzada de los guís de la mesa Lubricación forzada (como an- terior) y engranajes motores Cabezal del costado (derecha) Cabezal del costado (izquierda) 2 cabezales laterales 2 correas de transmisión, per- pendiculares 4 (como anterior) 2 correas para transmisión paralela 4 correas para transmisión paralela Agréguese motor	Transmissão por 4 correias Transmissão por caixas de engrenagens  Avanço motriz angular para o cabeçote lateral Incluindo motor de velocidade variavel  Incluindo motor de velocidade const- ante Incluindo motor reversível Avanço motriz transversal para o cabeçote lateral Avanço motriz transversal para o cabeçote lateral do barramento paralelo Lubrificação forçada para as guias de mesa Lubrificação forçada para as guias da mesa e as engrenagens motoras Cabeçote lateral (direito) Cabeçote lateral (esquerdo) Ambos os cabeçotes laterais 2 correias de transmissão em angulo recto 4 idem 2 correias de transmissão paralelas 4 idem Instale motor	Commande à 4 courroies Commande par engrenages  Avance automatique du porte-outils  Y compris moteur à vitesse variable  Y compris moteur à vitesse constante  Y compris moteur réversible Embrayage rapide pour raboter les côtés Embrayage rapide pour raboter les bouts  Graissage forcé des guides de la table  Graissage forcé des guides de la table et des engrenages de commande Tête latérale (droite) Tête latérale (gauche) Deux têtes laterales 2 courroies pour commande à angle droit 4 idem 2 courroies pour commande parallèle 4 courroies pour commande parallèle Commande par moteur	ft. m. Code word		
CAR WHEEL BORING MACHINES		MAQUINAS DE MANDRILAR RUEDAS DE VAGONES		TORNOS PARALLELOS PARA FODAS DE LOCOMOTIVAS		MACHINE A ALESER LES ROUES DES VAGONS	
CUHCU CUHFO CUHKE	All steel driving gear Belt operated crane Compressed air crane	Todos los engranajes de acero Grúa accionada por correa Grúa accionada por aire com- primido	Todas as engrenagens motoras de aço Grindaste operado por correa Grindaste operado por ar comprimido	Tous les engrenages en acier Palan à courroie Palan à air comprimé	ft. m. Code word		