

SHAPERS

FINE SHAPERS SINCE 1888

Our Specialty—Shapers

Since 1888, Smith & Mills Shapers have been favorite machine tools the world over. That is because of their operating convenience, ability to remove metal fast when roughing, equal ability to give accuracy and fine surface quality on finishing cuts—plus long life and maintenance economy.

Base, column, ram and tool head, cross rail, apron and table, all literally are designed together and tied together so that overhang and deflection are reduced to a minimum. The whole Smith & Mills Shaper—regardless of model or size—is as close to being a “structural unit” as is possible in any machine tool involving revolving, swinging, sliding and adjustable parts, and unit assemblies.

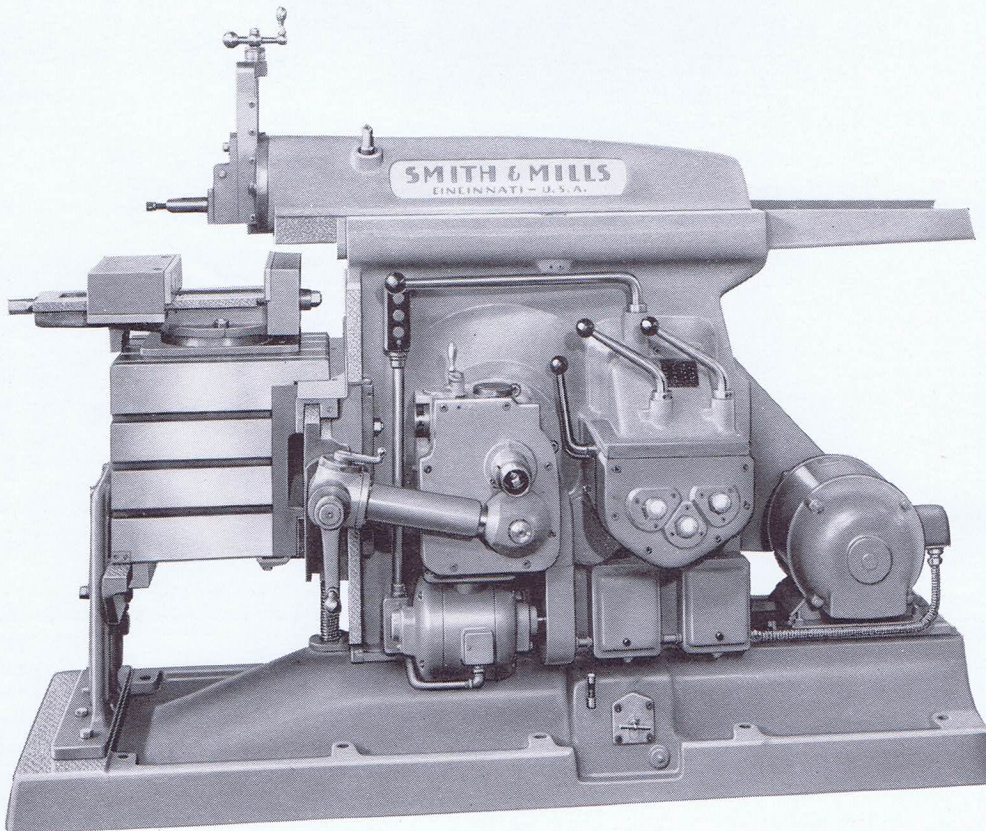
Smith & Mills engineering is—and always has been—a healthy combination of theoretical understanding of mechanisms; metallurgy, machine design and electrification—plus

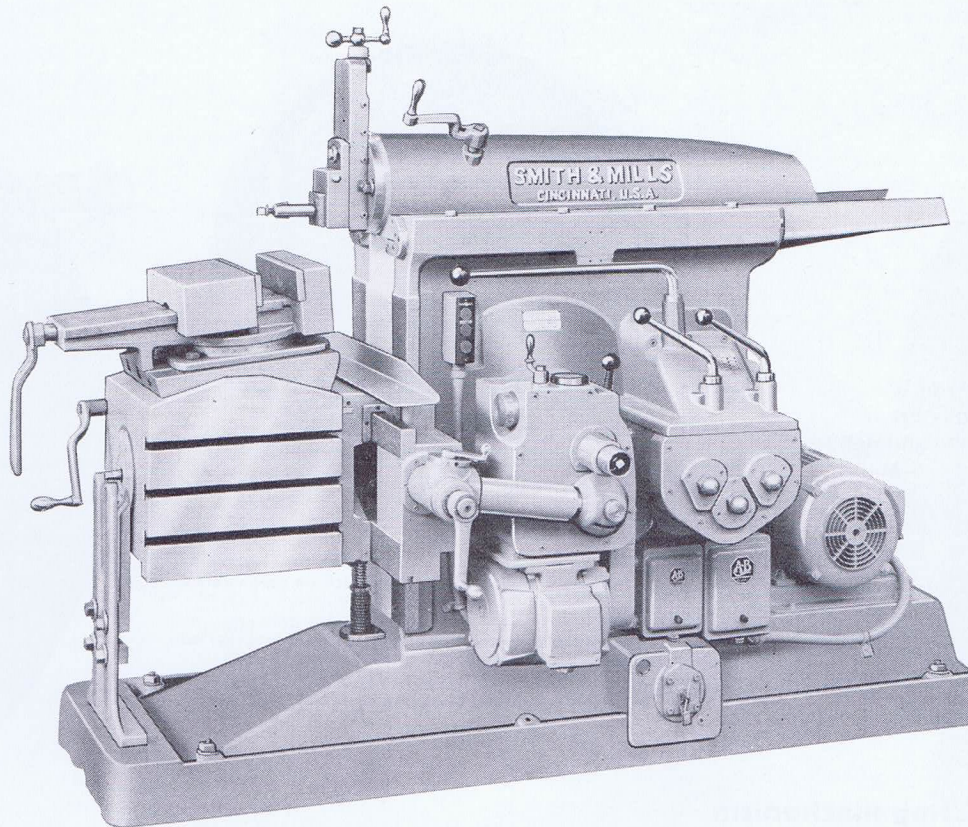
inventive ingenuity, plus more than sixty years of practical experience with shapers in all kinds of shops under all sorts of conditions on every variety of work.

Smith & Mills Shapers are built under supervision of men who always have specialized in this line of work. Castings of finest machine tool quality are used—highly stressed parts being of semi-steel. Shafting and gears are made of high tensile alloys, heat treated to give maximum strength and wearing quality. Jigs, fixtures, special tools and gauges insure accuracy of machines and interchangeability of parts.

Widespread, well established sales and service facilities—several distributor organizations having represented Smith & Mills for more than fifty years—insure prompt, efficient attention to your Shaper needs wherever you may be located.

**plain
box table**



**universal
table****standard and heavy duty shapers
designed for modern tool room and production service**

Shapers rank with engine lathes as basic machine tools in all kinds and sizes of metal working shops. As basic machine tools they are called upon to perform all sorts of surface machining, ranging from simple repair jobs to complicated tool and die work—and from single pieces to large lots involved in quantity manufacturing.

Smith & Mills Shapers are available in models and sizes best suited to meet modern demands over this widely diversified field of activity. Accessories and attachments listed in this catalog further increase their usefulness.

Standard Duty machines are available in 20 and 24-inch strokes. Heavy Duty models are available in 16, 20, 25, 28, 32 and 36-inch strokes. All sizes of both models regularly can be furnished either as Plain Table or as Universal Table Shapers—or on special order with Revolving Tables.

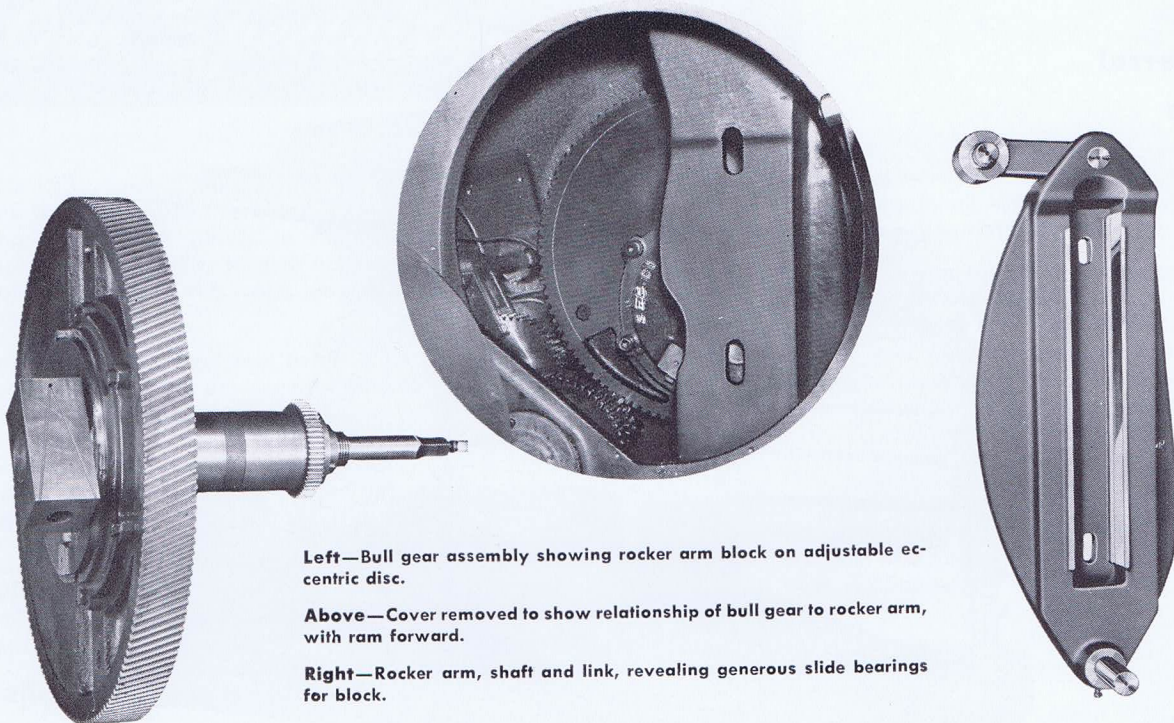
Smith & Mills Standard Duty Shapers are designed to handle efficiently average varieties and average runs of tool room and production work. Basic design features—including Solid Ram, Stroke-Changing Mechanism and conveniently Centralized Controls—characterize all sizes in this Standard Duty line. They are economical and highly satisfactory on run-of-the-shop shaper work.

Smith & Mills Heavy Duty Shapers are designed from base to ram with heavy duty service primarily in mind. Plus factors are built into every detail and sub-assembly to hold limits and to resist deflection and wear under continuous high speed operation using heavy feeds and maximum power. These machines have stamina and power to handle any such heavy duty, high production work within their generous dimensional limits.

Not only are these Heavy Duty Shapers star performers on heavy tool and die work, but also they give entirely new conceptions of efficiency and money-making ability of modern shapers on a wide variety of production work—including long runs of complicated parts.

Smith & Mills Shapers have many distinctive features which are embodied in both Standard and Heavy Duty models in all sizes. These features have evolved from Smith & Mills' many years of specialization in Shaper design. In every case they have been thoroughly proved in actual service under all kinds of working conditions.

In the following pages of this catalog outstanding Smith & Mills features are fully described and illustrated.



Left—Bull gear assembly showing rocker arm block on adjustable eccentric disc.

Above—Cover removed to show relationship of bull gear to rocker arm, with ram forward.

Right—Rocker arm, shaft and link, revealing generous slide bearings for block.

stroke adjusting mechanism

Another outstanding feature of Smith & Mills Shapers, is the closely knit bull gear-rocker arm assembly which constitutes ram reciprocating mechanism. An important detail in this assembly is the unique "gear-within-a-gear" by means of which the throw of rocker arm—and thereby length of stroke of ram—is regulated to suit work. Bull gear itself is a rugged, accurately machined semi-steel casting with precision-cut helical teeth on its periphery. Fitted into an eccentric recess in its heavy web—where it is held in place by a bonnet—is a saucer-shaped internal gear with which a husky crank pin is cast, integral and off-center.

When this internal gear is revolved in its recess in the bull gear to the point where axis of crank pin and axis of bull gear coincide—crank has zero throw. Rocker arm and ram therefore remain stationary. On the other hand, if internal gear now is revolved 180-degrees in its recess in the bull gear—thus bringing crank pin close to periphery of bull gear—crank has maximum throw. This imparts maximum throw to rocker arm and maximum stroke to ram. Intermediate settings give intermediate lengths of stroke.

Adjustments of ram stroke are accomplished exactly and easily by revolving stroke change shaft which extends to operator's side of shaper through center of bull gear shaft. This shaft carries a spur gear at its inner end. This meshes with an idler pinion which in turn meshes with internal gear.

Revolving stroke change shaft clockwise lengthens stroke of ram. Revolving it counter clockwise decreases stroke. Direct reading dial coupled to this mechanism, shows ram stroke in inches and fractions thereof, regardless of whether or not machine is operating.

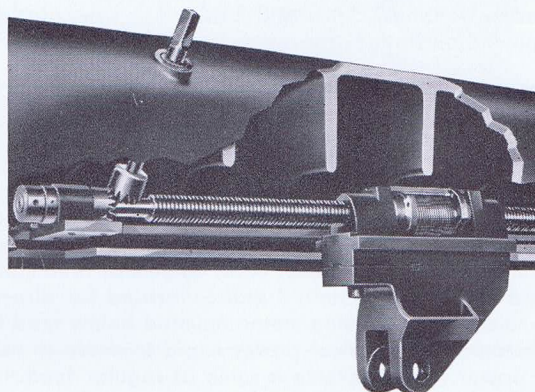
Stroke settings are positively locked by a square head screw protruding from stroke changing shaft. Double socket removable crank takes care of setting and locking. Locking screw seats crank pin gear tightly against web of bull gear. This locks bull gear assembly into what amounts to a solid unit, thus eliminating a common source of "knocking."

Smith & Mills Rocker Arm is scientifically designed for strength and rigidity without excess weight. It is a semi-steel casting carrying a large diameter pivot at its lower end. Pivot rocks in double bearings in base of column. At its forked upper end a rugged, bronze bushed steel link connects rocker arm to ram assembly. Rocker arm block is alloy steel, hardened and precision ground. It runs on a big bronze bushing pressed on crank pin. This block slides in generously proportioned, accurately fitted, non-adjustable flat guides forming sides of the slot. This whole closely knit bull gear, crank, rocker arm and block assembly insures smooth, powerful cutting action. It gives highly efficient "quick return."



Above—Smith & Mills Rigid ram showing solid “backbone.”

Right—Self-locking mechanism which holds “ram-to-work” setting.



solid ram and ram adjustment to work

Smith & Mills were the originators of the Solid Ram. The Solid Ram, the backbone of the Shaper was developed, patented and used exclusively by Smith & Mills for many years and has proved to be superior to any other type of ram design. No amount of ribbing of slotted rams can take the place of the “unbroken backbone” of Smith & Mills Solid Ram.

Adjustment of Ram-to-Work Smith & Mills designed ram not only does away with the harmful slot, but also solves the problem of making one operation of adjusting ram-to-work and locking this setting. On other shapers operator has to “crank the ram to position”—then actuate a separate locking device on top of ram to hold it in that position. On a Smith & Mills Shaper he simply cranks ram to position. Adjustment is self-locking—positively self-locking.

Self-locking adjustment is accomplished by a spring-loaded divided nut mounted in the movable ram-carrier. Its action is similar to that involved in eliminating back lash from

feed works of “climb milling machines.” Not only does this ingenious device accomplish self-locking of Smith & Mills ram settings, but also it compensates for any wear which eventually may occur between adjusting screw and nut. Actually such wear is minimized, because spring-loaded nut elements do not “work” on screw when ram reciprocates.

Another important point in connection with Smith & Mills Solid Ram, is that it can be adjusted to suit work while reciprocating. This is particularly important on tool and die work and other precision operations involving close clearances between tool and work at end of cutting strokes.

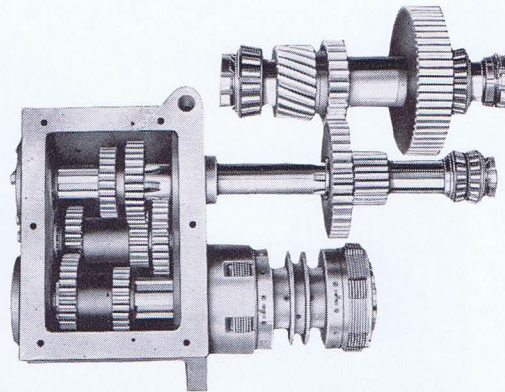
These features—rigid unbroken ram design, a single self-locking ram positioning device which is self-compensating for wear, and adjustment of the ram while reciprocating—have made Smith & Mills Shapers the leaders where accuracy, long life, and economy of operation are important factors.

outstanding design features

transmission, clutch and brake

All speed changes on Smith & Mills Shapers are selective. They can be made without working through intermediate steps. 16, 20, 25 and 28-inch machines have two sets of compound gears housed within column and two shifting cluster gears in external gear box. Together these give a total of eight changes of speed. 32 and 36-inch machines have three sets of compound gears in addition to the two sets of cluster gears in gear box. On these machines a total of twelve speed changes can be attained. Forged, heat treated alloy steel transmission gears are mounted on multiple splined shafts running in anti-friction bearings. Gears are cut to the stub tooth system. This gives ample tooth thickness at pitch line to withstand impact loads unavoidable in shaper operation.

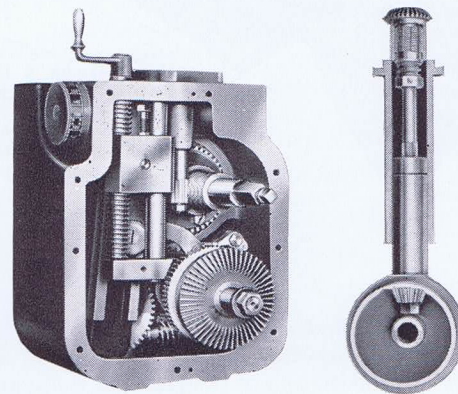
Duplex multiple disc unit functions at one end as a clutch and at the other end as a brake. Actuation of both is by single lever. Gears, bearings, clutch and brake are lubricated by constantly renewed oil bath fed direct from lubricant pump.



Details of transmission used on 16, 20, 25 and 28-inch shapers. 32 and 36-inch machines have similar system—but have three sets of compound gears.

feed and power rapid traverse

Table feed mechanism is of compact adjustable crank design—amount of feed being varied by changing position of crank yoke by means of a screw. Feed changes can be made while shaper is running or at rest. In either case, amount of feed can be observed on a conveniently located dial calibrated for direct reading. An auxiliary non-reversing motor mounted below feed box, provides horizontal and vertical power rapid traverse to table. Direction of power rapid traverse is same as regular feed. It is controlled by feed lever located on end of cross rail. Power rapid traverse functions through regular feed works. It is independent of amount of feed which happens to be set. Motor armature remains stationary except when rapid traverse actually is engaged. Power rapid traverse can be operated while shaper is at rest. While ordinarily furnished as standard equipment, power rapid traverse can be omitted if so desired.



Left—Feed box with cover removed showing details of feed changing system.

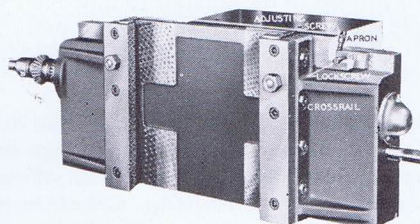
Right—Feed Telescope Sleeve

apron and cross rail

Smith & Mills apron and cross rail design and construction are thoroughly in keeping with that of the Solid Ram. Like all other details of these shapers, their design is the combined result of sound engineering, plus good common sense, plus long experience under all kinds of operating conditions.

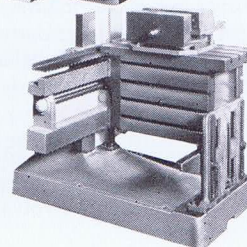
Cross rail is a casting of rigid box design. Like vertical ways on column to which it is gibbed, its generous cross ways are of square construction, widely spaced to give solid support to apron and table.

Apron likewise is a single casting. Its strong upper lip actually hooks over upper way of cross rail. There is a cross taper gib at the upper, main loadcarrying surface of the cross rail. Either end of this gib can be adjusted independently to compensate for uneven wear. This eliminates difficult full length scraping necessary with other designs.



Left—Rear view of cross rail and apron assembly showing how apron is gibbed to ways on column.

Right—Front view of complete assembly. Apron is "hooked" to cross rail. Plain table is doweled and bolted to apron.



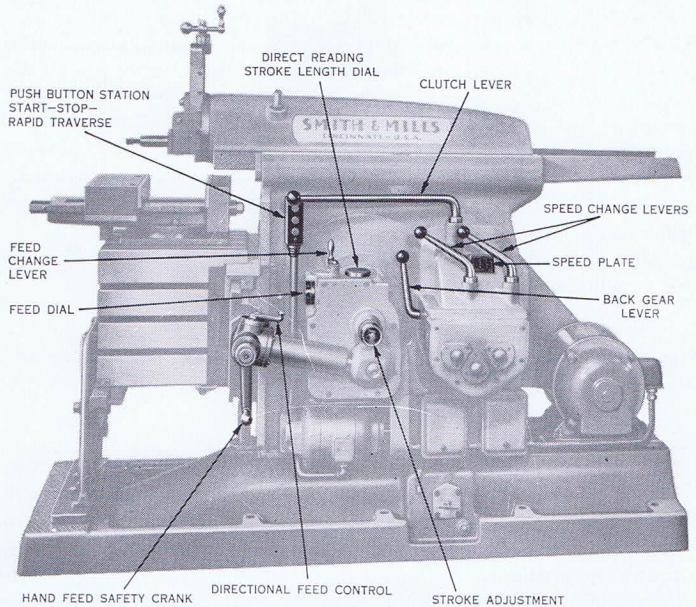
centralized control

Experienced operators prefer Smith & Mills Shapers because they are easy and convenient machines to run. They prefer them because of their ability to remove metal rapidly when "roughing." They prefer them because they give highly satisfactory accuracy and surface quality on finishing cuts.

Controls on Smith & Mills Shapers not only are centralized but also are expertly "tailored" to fit operators. For example, clutch lever—which is the most used control—is at natural location to expedite starting, stopping and "inching" while operator keeps close watch on action of tool.

Feed directional control, feed change back gear, and speed change levers all are equally handy and easy to actuate. Large direct-reading stroke and feed dials are mounted on feed box where they afford maximum visibility. One complete turn of feed change handle varies feed by 0.010 inch, making computing easy.

Start, stop and power rapid traverse push buttons are strategically grouped at upper left of column. Action of table feed lever is directional—that is, lever is "thrown" in the same direction in which feed is required. Manual feed by means of a crank can be used instead of power feed when so desired.



lubrication

Unfailing lubrication of Smith & Mills Shapers is insured by pressure system designed around rotary oil pump which is chain-driven from main drive shaft. Pump is submerged in oil reservoir in base of machine. No check valve is needed. Pump never needs priming. When shaper starts, oil circulates—regardless of how long machine has been idle.

Pump draws oil through generous filter submerged in reservoir. Only attention required is turn of cleaning handle every eight hours.

Pump delivers oil to manifold in rear of column. From there it is distributed to ram ways, hub of bull gear, rocker arm slide and rocker arm block, link bearings, clutch and brake, drive pinion bearings, bearings of all drive and driven shafts, and all gears within the column. Gears in speed box and bull gear mechanism—including bearings—operate in constantly renewed oil bath.

Sight windows at top of column give visual check on oil circulation. Gauge glass on side of base gives constant check on oil level in reservoir. Reservoir is filled through opening at rear of column—uncovered when ram is at full forward position. Sump can be drained by removing plug below filter.

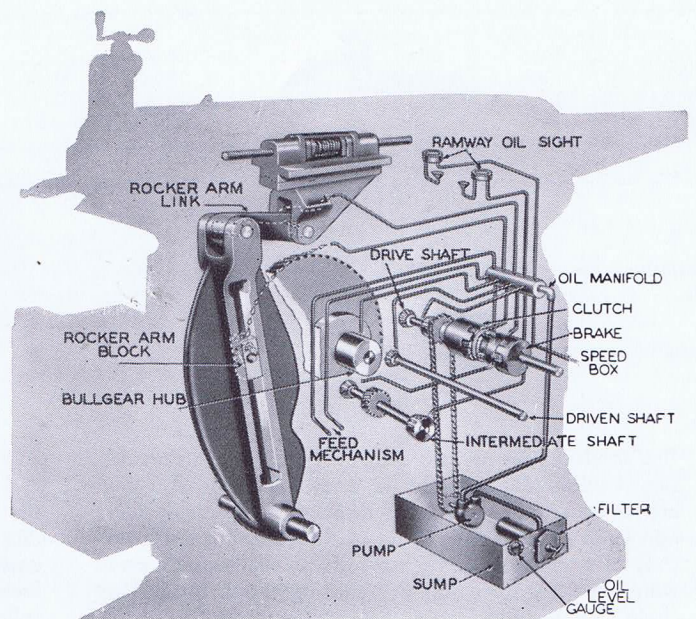
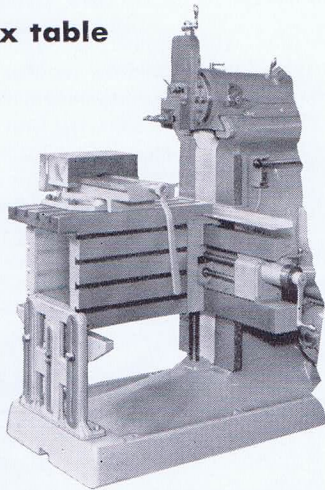


table types

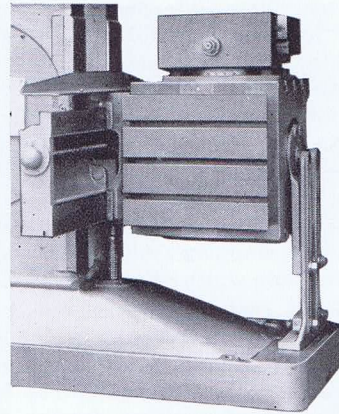
plain box table



Finished and T-slotted to hold vises, standard and special fixtures and work on top and two sides, these rigid, box-type plain tables are satisfactory for average run of tool room, machine shop and manufacturing shaper operations.

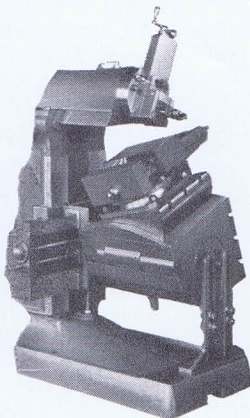
In addition to being firmly doweled and bolted to apron, they have wiper-equipped sliding support on an adjustable rail carried on the front support.

revolving table

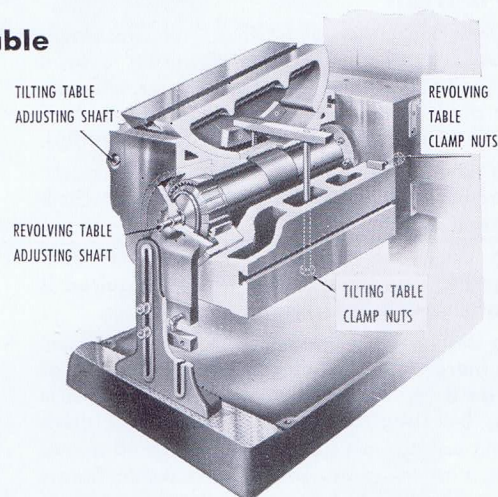


This versatile table, which can be revolved 90-degrees either way around heavy trunnion attached to apron, is especially useful for die work and other angular machining. When swivel-base vise is used on this table, compound angle jobs can be dealt with efficiently without special fixtures. Table is revolved around its trunnion by worm and worm wheel mechanism actuated through crank connected at front.

universal table



This combination of 360-degree revolving table and semicircular tilting table is another Smith & Mills improvement. It features the Heliocentric Gear Reduction Unit. By centering main table adjusting shaft on axis of trunnion, this Heliocentric system does away with back breaking job of "chasing crank around a circle" when setting main table. After setting is made, load is taken off trunnion by clamping table to apron.



Auxiliary table can be tilted either way to angles up to 15-degrees to centerline of ram by cranking a shaft at upper left hand corner of main table. Setting is locked by cross bar riding on twin segments inside casting. This bar is drawn down by two bolts whose locking nuts are at bottom of main table. Work is solidly supported because auxiliary table seats firmly in its accurately scraped recess.

Plain Table & Universal Table Machines

| SIZE OF MACHINES | 16" HVY. | 20" STD. | 20" HVY. | 24" STD. | 25" HVY. | 28" HVY. | 32" HVY. | 36" HVY. |
|--------------------------|-------------------|-------------------|----------------|---------------|----------------|---------------|----------------|---------------|
| RAM | | | | | | | | |
| Extreme Length of Stroke | 17" | 21" | 21" | 25" | 26" | 29" | 33" | 37" |
| Strokes per Minute | 11-149 | 11-149 | 10-133 | 10-133 | 8-114 | 8-114 | 8-106 | 8-106 |
| Speeds | 8 | 8 | 8 | 8 | 8 | 8 | 12 | 12 |
| Ram Bearing in Column | 33 1/2" x 10 1/2" | 33 1/2" x 10 1/2" | 38" x 11 1/2" | 38" x 11 1/2" | 43" x 12 1/2" | 43" x 12 1/2" | 48" x 13 1/2" | 48" x 13 1/2" |
| TOOL HEAD | | | | | | | | |
| Vertical Travel | 7" | | 8" | | 8 1/2" | | 9" | |
| Size of Tools | 3/4" x 1 3/4" | | 7/8" x 1 7/8" | | 1" x 2" | | 1" x 2" | |
| FEEDS | | | | | | | | |
| No. of Feeds | 10 | | 15 | | 15 | | 15 | |
| Feed Range | .010" to .100" | | .010" to .150" | | .010" to .150" | | .010" to .150" | |
| WISE-SINGLE SCREW | | | | | | | | |
| Size of Jaws | 12" x 2 1/2" | | 13" x 3" | | 13" x 3" | | 15" x 3 1/2" | |
| Opening | 13 1/2" | | 16" | | 16" | | 16 1/2" | |
| MOTOR DRIVE | | | | | | | | |
| Speed of Drive Shaft | 350 R.P.M. | | 350 R.P.M. | | 350 R.P.M. | | 425 R.P.M. | |
| Motor Horsepower | | | | | | | | |
| 1800 R.P.M. constant | 3-5 | | 5-7 1/2 | | 7 1/2-10 | | 10 | |

Plain Table Machines Only

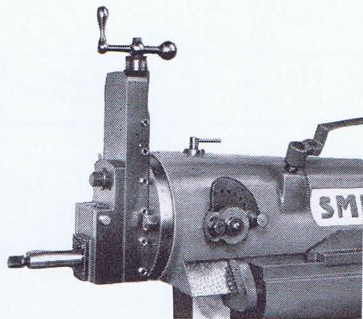
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|-----------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| TABLE | | | | | | | | |
| Horizontal Travel | 25" | | 27" | | 29 1/2" | | 33" | |
| Vertical Travel | 14 1/2" | | 15" | | 14" | | 14" | |
| Min. Distance from Ram | 2" | | 3 1/2" | | 4" | | 3 1/2" | |
| Max. Distance from Ram | 16 1/2" | | 18 1/2" | | 18" | | 17 1/2" | |
| Length of Top | 17" | 20" | 21" | 24" | 25" | 28" | 32" | 36" |
| Width of Top | 14 1/4" | 14 1/4" | 16 1/2" | 16 1/2" | 17 1/2" | 17 1/2" | 18" | 18" |
| Depth | 15" | 15" | 16" | 16" | 17" | 17" | 18 1/2" | 18 1/2" |
| Net Weight including Motor-(lbs.) | 4250 | 4450 | 5200 | 5400 | 6200 | 6400 | 8000 | 8200 |
| Domestic Shipping Wt. | 4850 | 5050 | 6000 | 6200 | 7200 | 7400 | 9000 | 9200 |
| Export Shipping Wt. | 5450 | 5650 | 6700 | 6900 | 8000 | 8200 | 9950 | 11,050 |
| Cubic Feet-Export | 154 | 154 | 234 | 234 | 236 | 236 | 318 | 318 |

Universal Table Machines Only

| | | | | | | | | |
|--------------------------------------|-------------------|------|---------------|------|---------------|------|---------------|--------|
| TABLE | | | | | | | | |
| Horizontal Travel | 25" | | 27" | | 29 1/2" | | 33" | |
| Vertical Travel | 14 1/2" | | 15" | | 14" | | 14" | |
| Size of Plain Surface | 15 3/4" x 13 3/8" | | 16" x 15" | | 20 1/2" x 16" | | 22 1/2" x 18" | |
| Size of Tilting Surface | 15" x 13" | | 15" x 13 1/4" | | 18 1/4" x 15" | | 22" x 16" | |
| Top Tilts either way | 15° | | 15° | | 15° | | 15° | |
| Max. Distance Plain Surface to Ram | 17 1/16" | | 19 3/8" | | 18 3/8" | | 18" | |
| Max. Distance Tilting Surface to Ram | 15 1/2" | | 18 1/8" | | 16 3/8" | | 15 3/8" | |
| Max. Rotation of Table | 360° | | 360° | | 360° | | 360° | |
| Net Wt. including Motor-(lbs.) | 4500 | 4700 | 5400 | 5600 | 6550 | 6750 | 8300 | 8500 |
| Domestic Shipping Wt. | 5100 | 5300 | 6200 | 6400 | 7550 | 7750 | 9400 | 9600 |
| Export Shipping Wt. | 5700 | 5900 | 6900 | 7100 | 8350 | 8550 | 10,350 | 10,550 |
| Cubic Feet—Export | 154 | 154 | 234 | 234 | 236 | 236 | 318 | 318 |

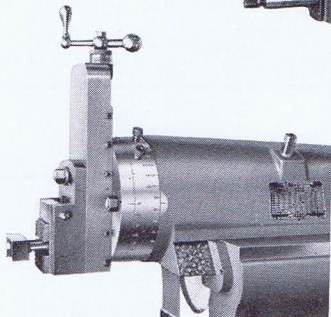
*16, 20 and 24-in. shapers equipped with single screw tool post. Will furnish heavy duty, double screw clamp type tool holder when so specified without extra charge.

**25, 28, 32 and 36-in. shapers equipped with heavy duty, double screw clamp type tool holder. Will furnish single screw tool post when so specified without extra charge.



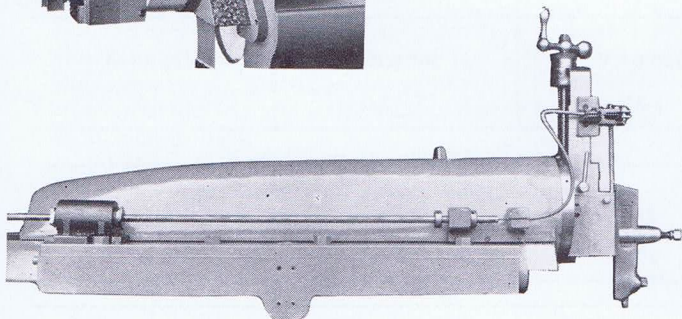
vertical feed to tool

This special feature provides automatic up or down feed to tool slide regardless of angle to which head is set. Mechanism built into ram turns feed screw during return stroke through action of strip cam paralleling ram. Any one of five feeds is selected by lever on operator's side of ram. Range is from 0.005 to 0.025-inch. Changes can be made with ram operating. Direction is determined by moving a small lever at top of ram—clockwise for "down," counter clockwise for "up" and parallel to ram for "off."



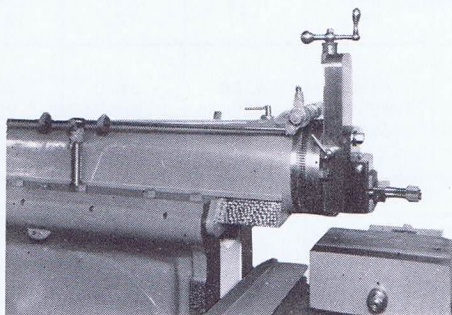
index tool head

Designed to facilitate angular tool settings more exacting than readily can be made with standard tool head, this special precision head permits quick setting within 0.05-degree limits. An important element in this assembly is a precision divided auxiliary disc interposed between face plate of tool head and end face of ram. This disc is graduated on both sides in such a manner that angular settings are "split" between bench mark on ram and another on the head face plate—the effect being similar to that of a vernier.



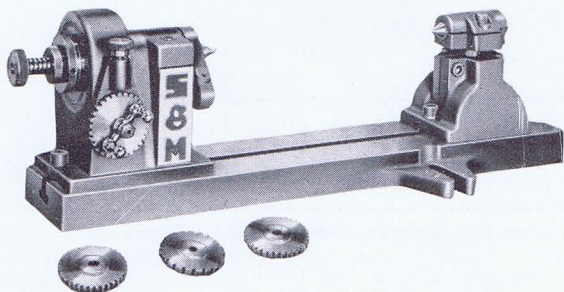
tool lifter

Automatic lifter keeps tool from dragging over work during back stroke. It is a "must" when using carbide tools as it prevents chipping of cutting edges. Operating rod is loose fit in stud on left front of ram and is carried in friction bushing on rear of ram cap. Sliding of stud on rod is limited by two discs adjusted to ram stroke. Rod works lifting and lowering linkage on head through flexible "push-pull" wire when ram stud strikes stops.



concave attachment

Special head for automatic concave machining embodies worm wheel tool slide disc pivoted on ram. Disc meshes with worm carried in bracket on top of ram. Worm is revolved step-by-step during return stroke by ratchet lever connected to rod paralleling ram. Rod slides through bushing mounted on rear of ram cap. It works ratchet arm when adjustable stops strike bushing. Thus tool is fed a predetermined amount along arc at each back stroke of ram. Radius is controlled by setting tool.



worm feed index centers

Attachment includes substantial slotted bed. However, head and tailstocks can be mounted directly on shaper table when nature of work makes that desirable. Headstock can be indexed either by degrees or divisions. Dial on worm-operated head is divided into 360 degrees. Four index plates—notched to 21, 30, 33 and 36 divisions—regularly are furnished. When bed is used, swing is 12-inches and work 18-inches long can be held between centers. Rising and falling tailstock permits accurate settings for tapered work. Weight complete is approximately 150 lbs.

tilting table top

This useful accessory readily can be applied to Smith & Mills Shapers with Plain Box Tables. Auxiliary table is pivoted to shaper table at ram end of heavy triangular side plates bolted to side T-slots. It can be tilted up to 15 degrees from horizontal front to back, by means of hand screw threaded through bar carried in the center T-slot of shaper table.

Setting is solidly locked by slotted side bars pivoted to rear of tilting table and clamped by bolts in side T-slots of shaper table. Tilting Table Top permits quick, efficient machining of tapered keys, gibs and similar parts. In many shops, time saved over and above makeshift setups—plus avoidance of spoiled work due to such makeshift setups—will liquidate cost of this accessory within a surprisingly short period of time.

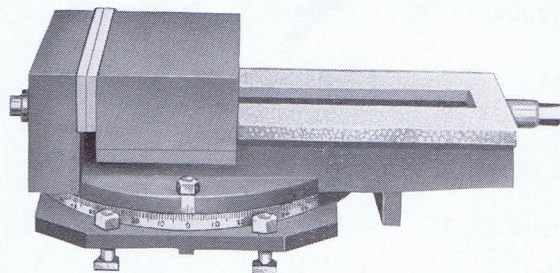
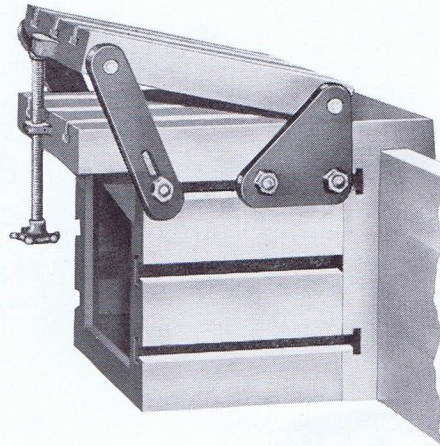
shaper vises

Single Screw Vise, parallel jaw type, comes as standard equipment unless otherwise specified. It is mounted on an accurately graduated swivel base which permits setting to any desired angle. Screw passes through both fixed and movable jaws, thus always is under tension when clamping. This avoids tendency to spring vise seat. Adjustable caps on movable jaw prevent work from rising when closing vise and are used to lock jaw in position.

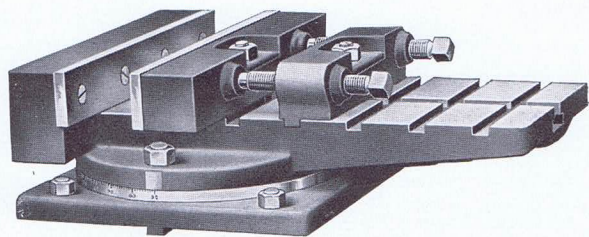
Double Screw Vise is designed for holding tapered parts rough castings and forgings. Movable jaw can be set angularly to fixed jaw to suit work. This is accomplished by two hardened clamping screws threaded through husky thrust block. Movable jaw and thrust block are locked to cross slotted seat by center bolts riding in longitudinal T-slot. This vise will be substituted for single screw type on any size shaper at no extra cost, when so ordered.

Mould Makers' Vise is of single screw design but has high, steel faced jaws for gripping moulds, dies and similar work. These vises are not standard equipment. They are available in place of single or double screw vises at reasonable additional cost.

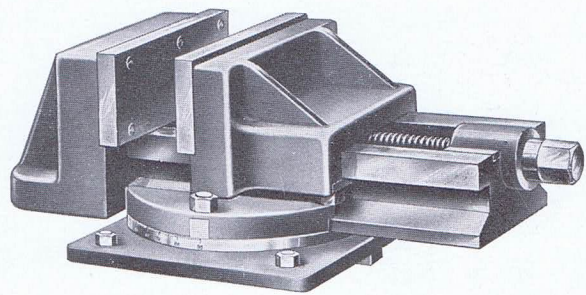
Changes from standard sizes of vises, special tapered steels for parallel jaws and hardened steels for vise jaws, all are priced extra.



Single Screw Regular Parallel Jaw Vise



Double Screw Vise



Mould Makers' Vise

| Size | Dimensions [in.] | | | Weight [lb.] approx. |
|--|------------------|-------|--------|----------------------|
| | Width | Depth | Opens | |
| REGULAR PARALLEL JAW VISE WITH BASE | | | | |
| 16 | 12 | 2 1/2 | 13 1/2 | 185 |
| 20-25 | 13 | 3 | 16 | 275 |
| 32-36 | 15 | 3 1/2 | 16 1/2 | 350 |
| DOUBLE SCREW VISE WITH BASE | | | | |
| 16 | 12 | 2 1/2 | 13 | 135 |
| 20-25 | 13 | 3 | 12 | 200 |
| 32-36 | 15 | 3 1/2 | 16 | 300 |
| MOULD MAKERS' VISE WITH BASE | | | | |
| 16 | 12 | 4 | 13 1/2 | 200 |
| 20-25 | 13 | 4 1/2 | 16 | 300 |
| 32-36 | 15 | 5 | 16 1/2 | 375 |

...Smith & Mills Shaper Div.

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