EFFICIENCY BULLETIN

LATHES
PLANERS
SHAPERS
RADIALS

THE AMERICAN TOOL WORKS CO.

CINCINNATI. U.S.A.

THE PURPOSE

THE PURPOSE of this bulletin is to familiarize the reader with the different types of machine tools built by The American Tool Works Co., and to direct attention to the interesting points of design to be found in each type of machine.

In the following pages we have purposely refrained from touching upon the methods of construction employed to produce the high degree of accuracy inherent in "American" Tools, as that is a subject deserving of individual treatment, and has been interestingly handled in our publication entitled "Accuracy" Bulletin.

Facts About Engine Lathes

No one type of Engine Lathe is adapted to all classes of lathe work. Certain classes of work can be most economically handled on a certain type of lathe, consequently we build "American" Lathes with four different types of headstocks, each one of which is suited to a definite class of work. Before buying a lathe, the advantages and adaptibility of each type to your work should be carefully investigated and considered.

The 4-step cone Single Back Geared Lathe is designed to handle a general class of work which does not require extreme power. It is the most generally used, and is recognized as the standard type of headstock.

The 3-step cone quick change Double Back Geared Lathe will handle much heavier work than the Single Geared, because of greater belt power due to the extra wide face of the cone pulley. This, together with the additional gear ratio, accommodates a much wider range for roughing and finishing work.

The 4-step cone Triple Geared Head is furnished only for our larger lathes—30-inch and up. The very high reduction obtained through the triple gears, combined with the great power delivered by the belt, insures sufficient power for performing the more severe classes of lathe work.

The Patented Geared Head Lathe is designed for all classes of work, and especially for very heavy roughing requirements. The "American" Patented Geared Head Lathe has proven itself the most powerful of any yet designed, which fact, combined with its wide field of usefulness and extreme simplicity, makes it a most desirable tool for rapid manufacturing purposes.

The following illustrations show the various sizes of "American" Lathes, and the different types of headstocks we are prepared to furnish. On page 11, details of the 36-inch Patented Geared Head are shown, also illustrations of the quick change gear box. Both of these mechanisms are new in design and embody features of unquestionable merit.

The descriptions given on the above mentioned pages treat these two subjects clearly and concisely and will undoubtedly be of interest to those interested in lathe design.

There are a number of other features worthy of mention, the most important of which we shall describe briefly in the following:—

BED—The type of bed used on "American" Lathes is one of the most important features of the machine. Its construction is radically different from the type ordinarily used in that the two inner Vees are dropped below the outer Vees, thus providing greater turning capacity than the rated size of the lathe would indicate. The value of this design lies in the fact that larger work can be handled in the lathe without raising it than in any other lathe built, size for size. The "Vees" are very wide and are hardened by an improved condensing process on sizes from 14-inch to 27-inch and are semi-steel on the larger sizes. Consequently the original accuracy of the lathe will be greatly prolonged, as the wear is thus confined largely to the carriage where it will not impair the alignment. On the 24-inch Heavy Pattern and larger lathes a rack is cast on the center rib, the tailstock being fitted with a pawl to engage the same for resisting end thrust.

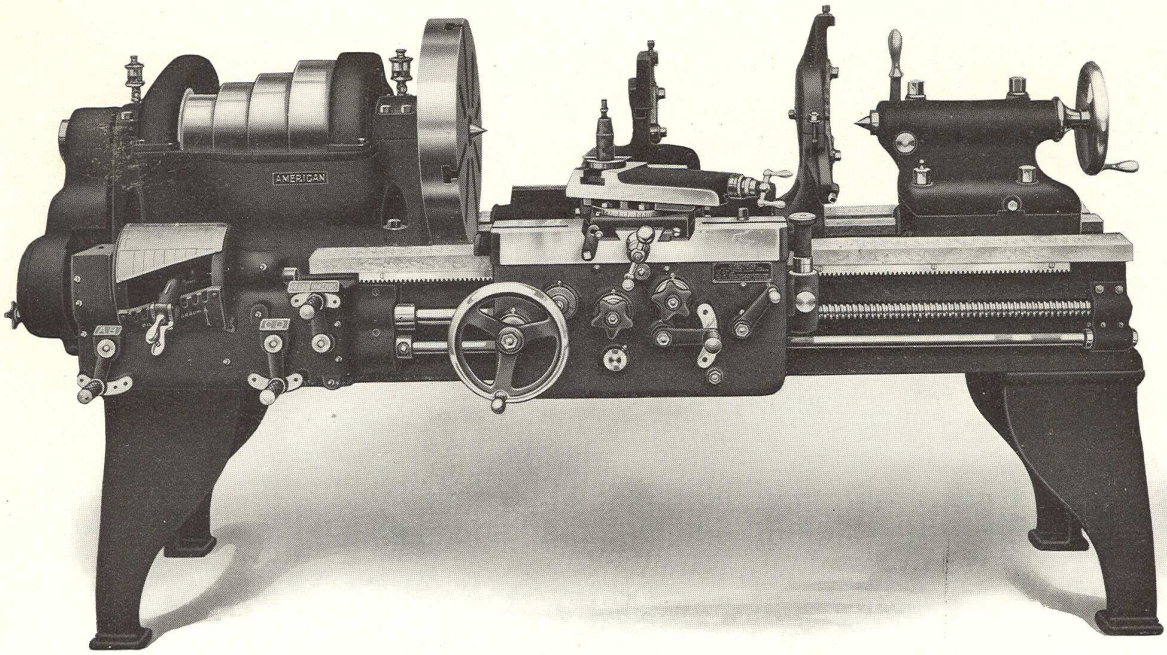
TAILSTOCK—Has extension barrel, thus providing necessary clearance to carriage bridge for turning short work. It is clamped in position by four bolts, the two in the rear being carried to the top of barrel for convenience in clamping. The barrel is not split, as formerly, for binding, the spindle now being securely fixed in place by means of a double plug binder, which clamps the same without affecting its true alignment.

APRON—Is of improved double plate construction which provides an outboard support for the studs. Rack pinion is withdrawable from rack on 20-inch and larger sizes, consequently all possibility of chatter is eliminated when chasing coarse pitch threads. Studs are case-hardened and ground and all loose running gears are bronze bushed. All inside bearings are oiled from central oil chamber and the oil is filtered through felt pads.

AUXILIARY QUADRANT—This feature permits the application of extra change gears for cutting all threads not obtainable thru the quick change mechanism. The flexibility thus obtained is one of the most valuable features of the "American" Lathe as its range or adaptability is practically unlimited.

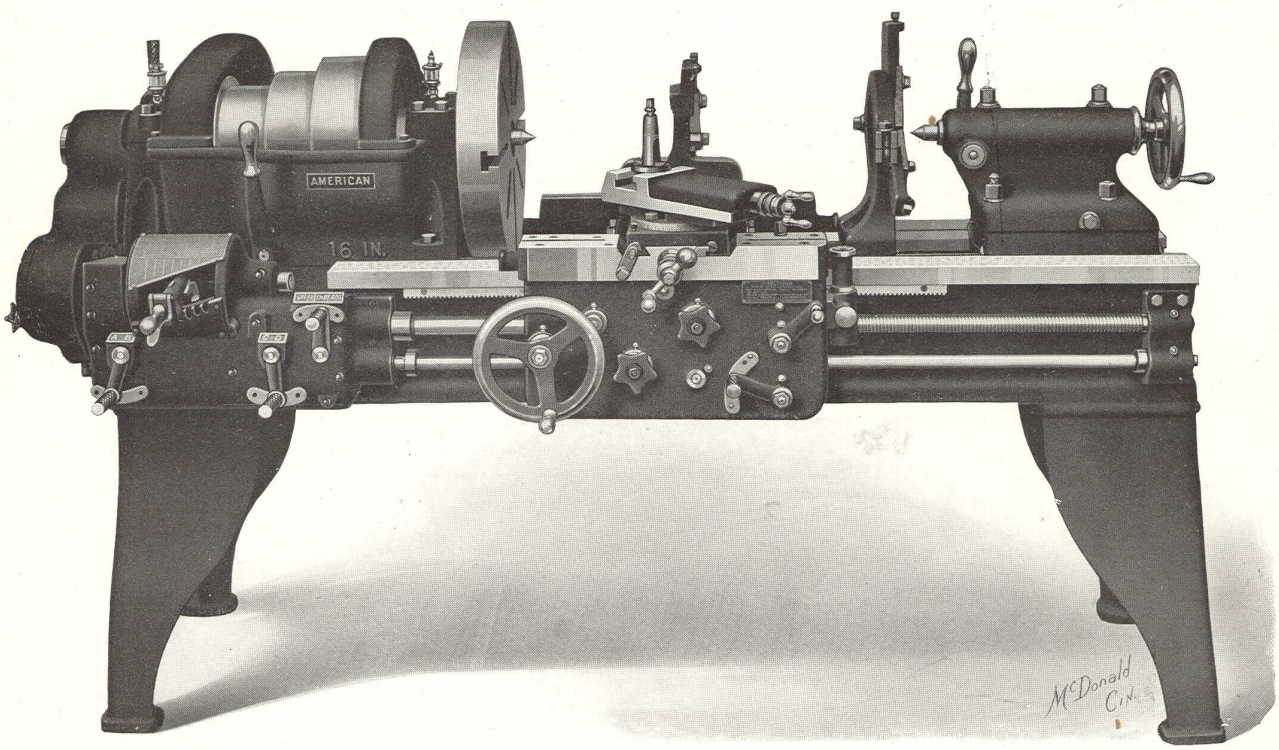
BRONZE BUSHED BEARINGS—It will undoubtedly be of interest to a prospective purchaser to know that the "American" Lathe is the only one built at this time having renewable **Bronze Bushes** in every bearing, and that every loose running gear is lined with Phosphor Bronze.

LUBRICATION—All important bearings are oiled thru our improved gravity oil pipes, prominently located, which hold a generous amount of oil.



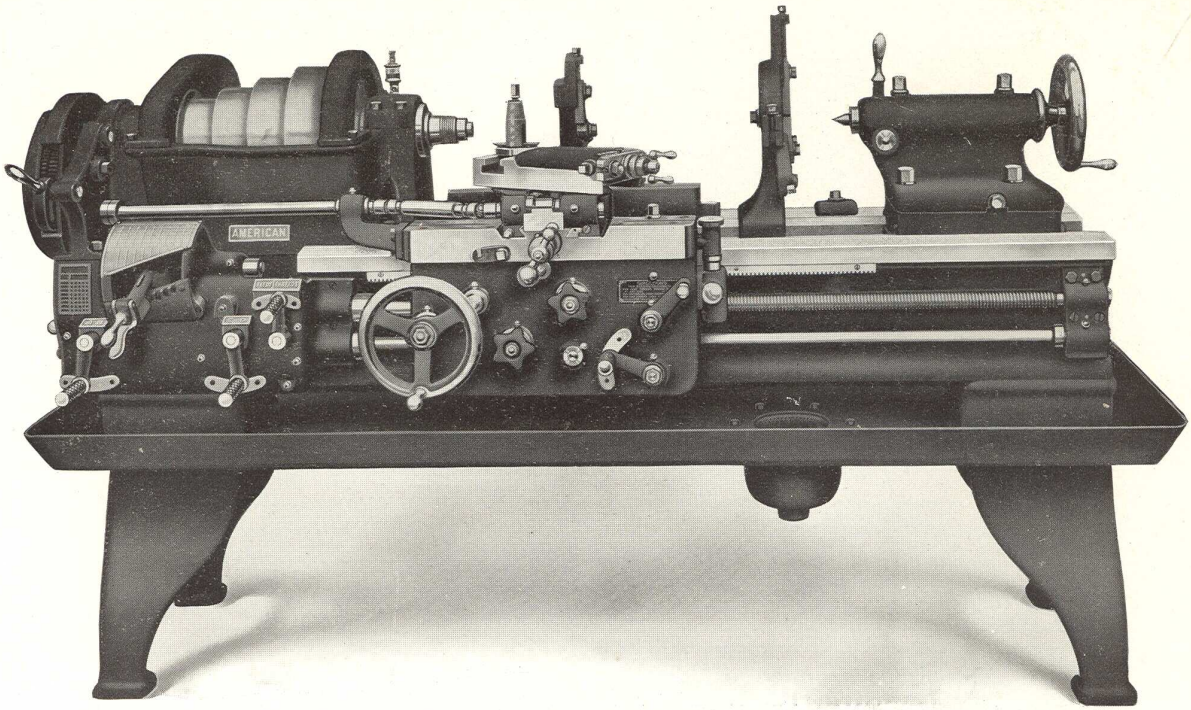
14, 16 and 18-inch "American" High Duty Lathe

4-Step Cone, Single Back Geared Head



14, 16 and 18-inch "American" High Duty Lathe

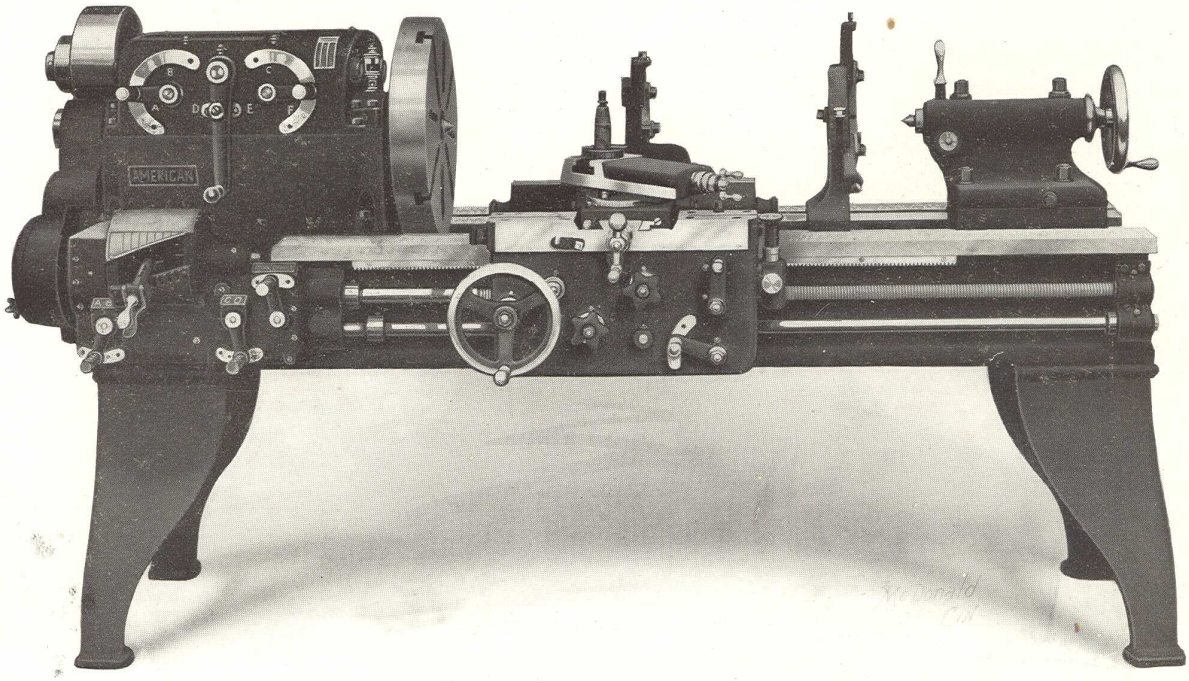
3-Step Cone, Quick Change Double Back Geared Head



14, 16 and 18-Inch "American" Tool Room Lathe

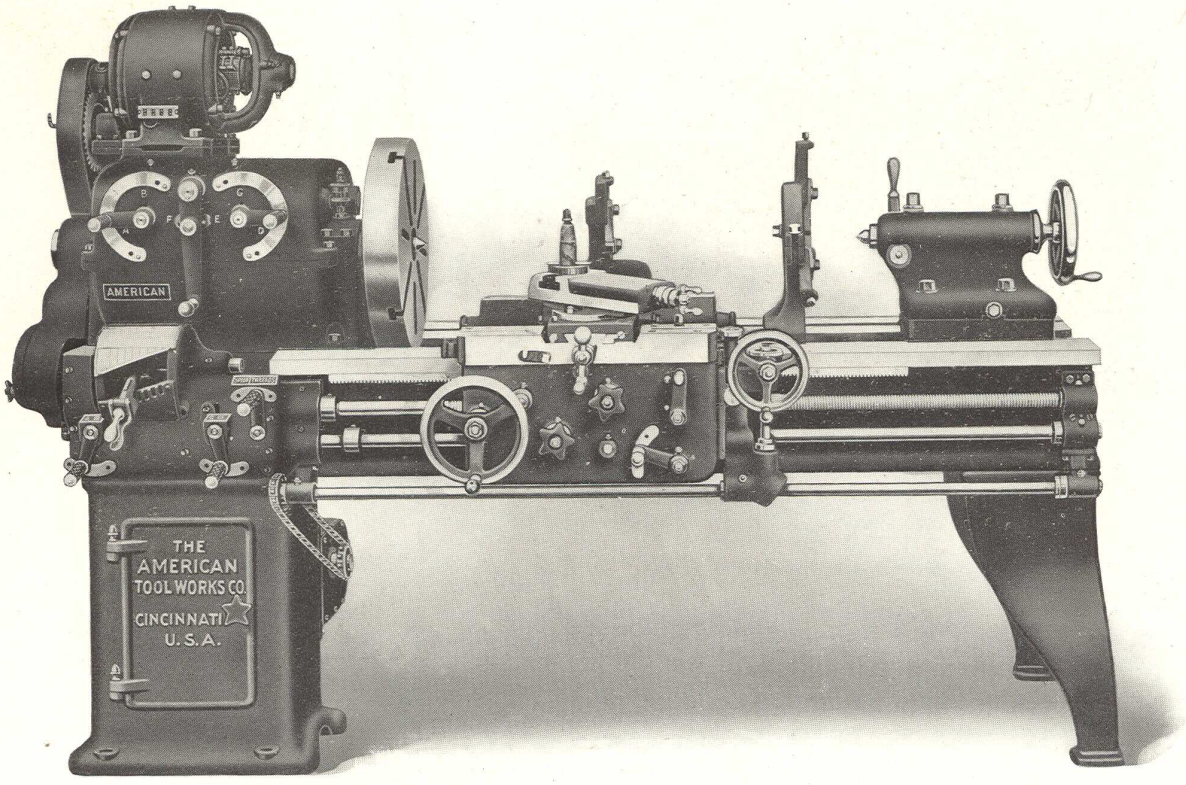
Equipped with Draw-in Collet Chuck, Taper and Relieving Attachments, Compound Rest, Pan and Quick Change Feeding and Thread Cutting Mechanism

A Complete Tool Room Lathe Combining the Highest Degree of Accuracy and Convenience of Operation



14, 16 and 18-Inch "American" High Duty Lathe

Belt Driven thru Patented 8-Speed Geared Head

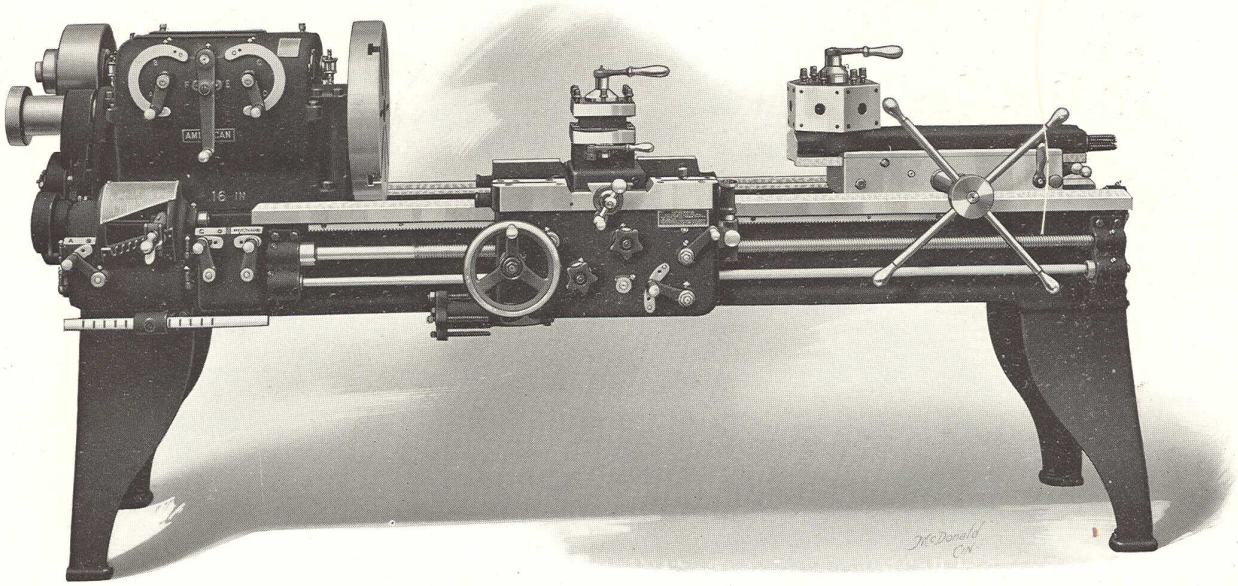


14, 16 and 18-inch "American" Motor Driven Lathe

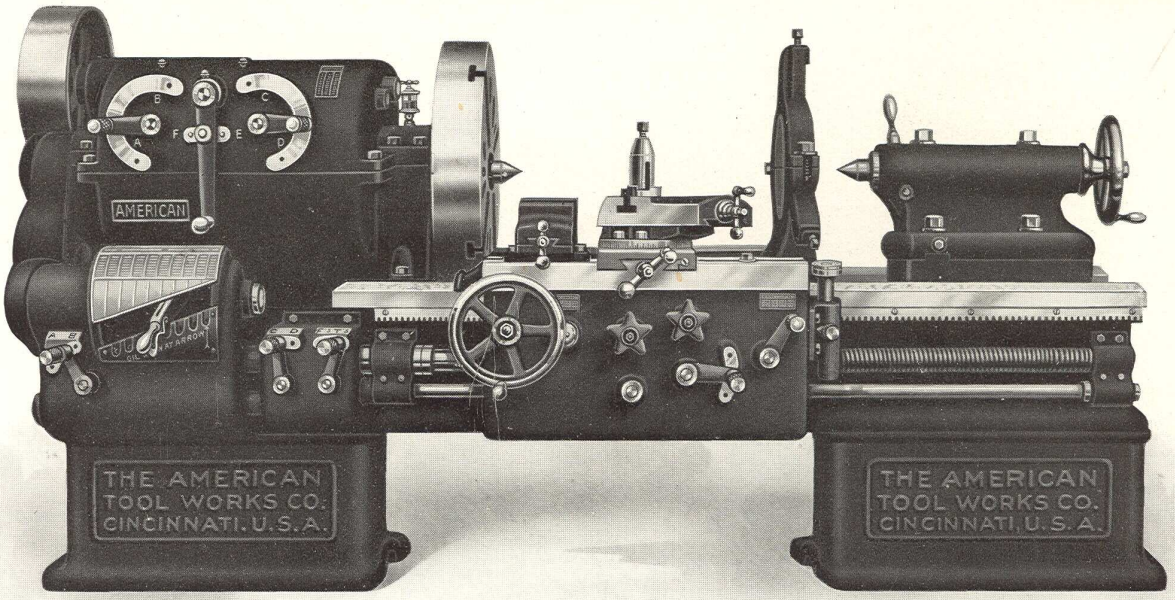
Motor Driven thru "Patented" 8-Speed Geared Head

Motor and Head Free from Vibration

Only Three Spur Gears from Armature Shaft to Driving Shaft in Head

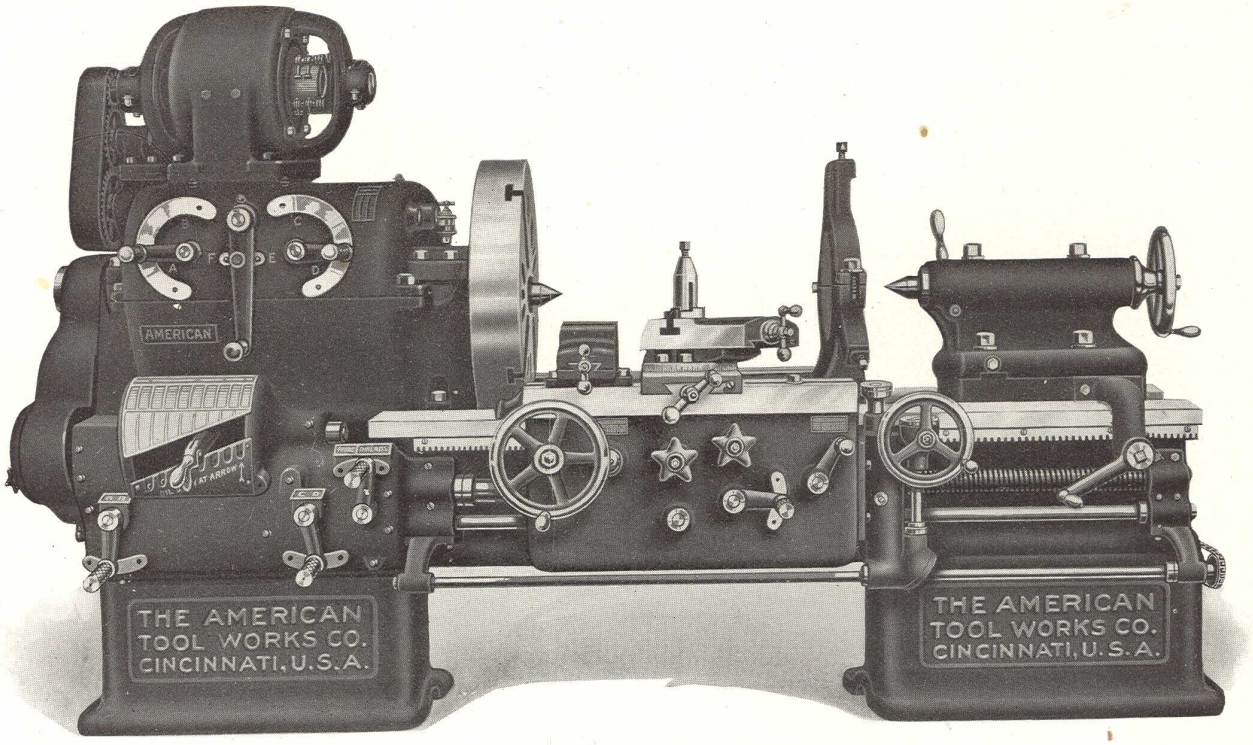


"American" High Duty Lathe with Turret on Shears, Power Feed, Turret Tool Post and Longitudinal Stops



20 and 24-inch Medium Pattern "American" High Duty Lathe

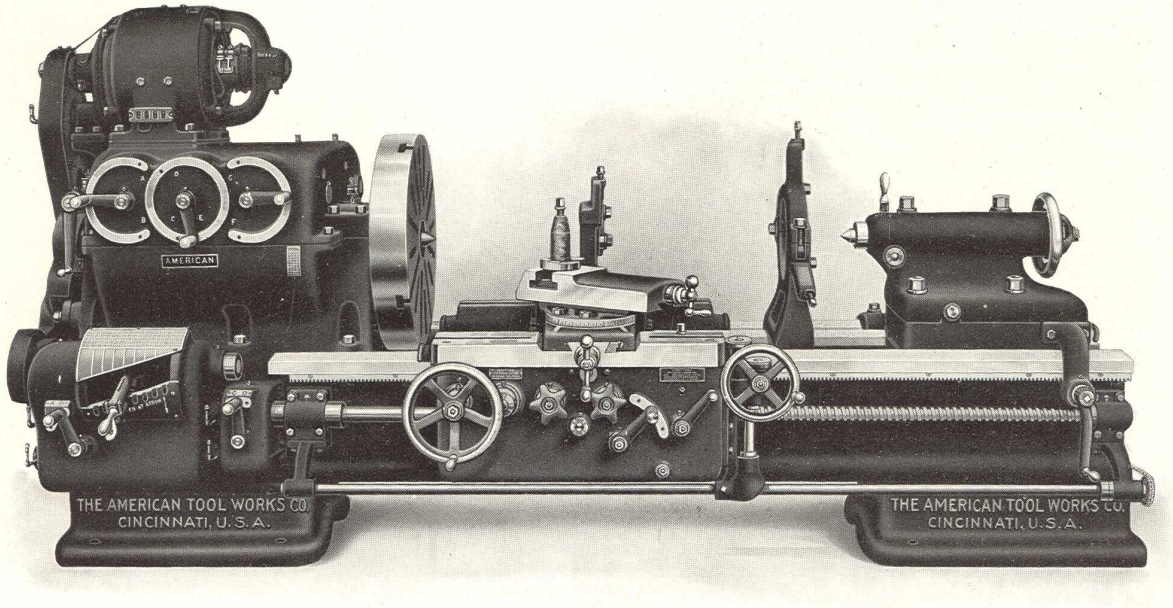
Belt Driven thru 8-Speed Geared Head



24-inch Heavy Pattern and 27-inch "American" High Duty Lathe

Motor Driven thru Patented 8-Speed Geared Head

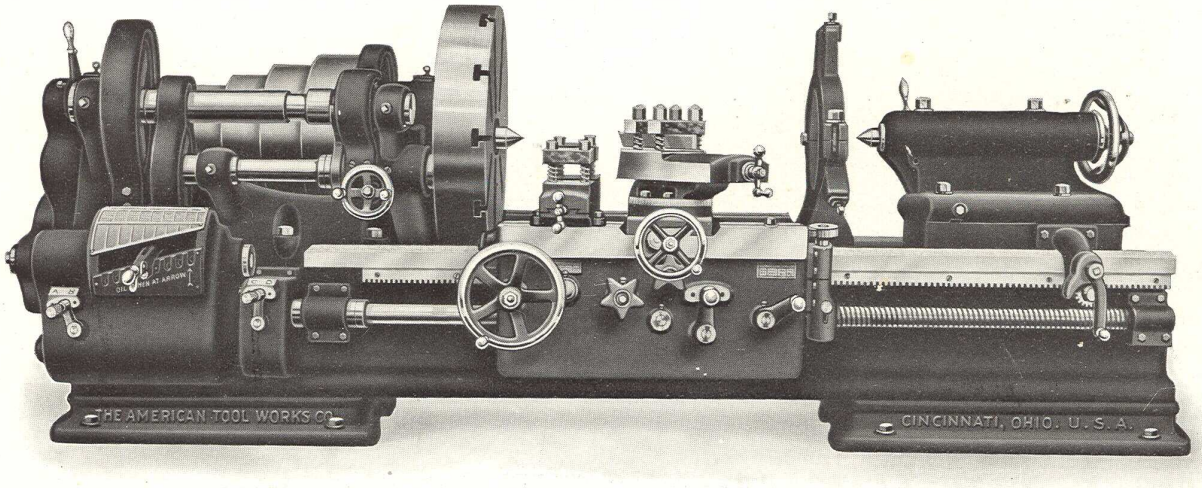
A Constant Speed Motor is used



30 and 36-inch M. P. "American" High Duty Lathe

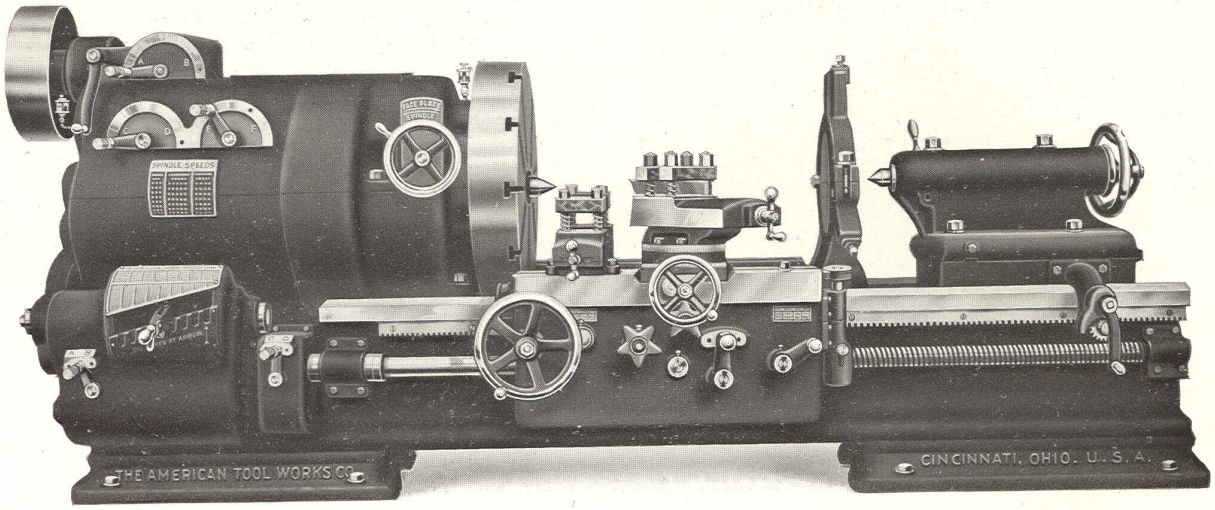
Motor Driven thru "Patented" 12-Speed Geared Head

A Constant Speed Motor Is Used



36 and 42-inch "American" High Duty Lathe

With Four Step Cone Triple Geared Headstock

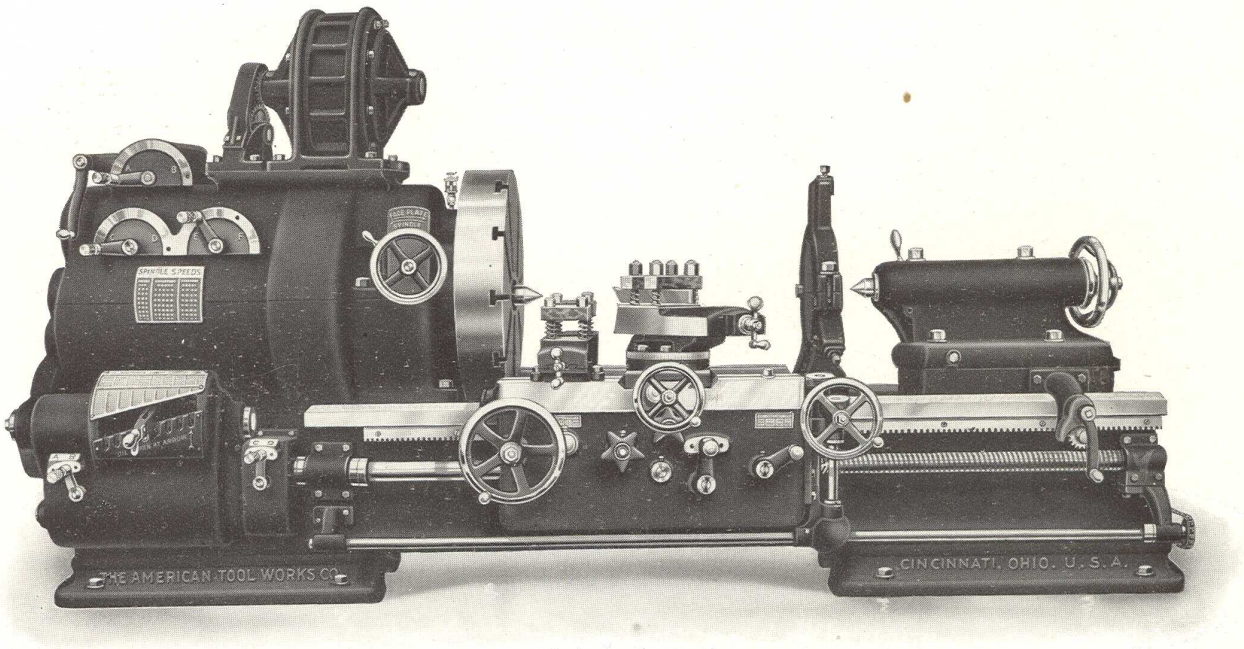


36 and 42-inch "American" High Duty Lathe

"Patented" Geared Head for Belt Drive

16 Spindle Speeds—Only 17 Gears

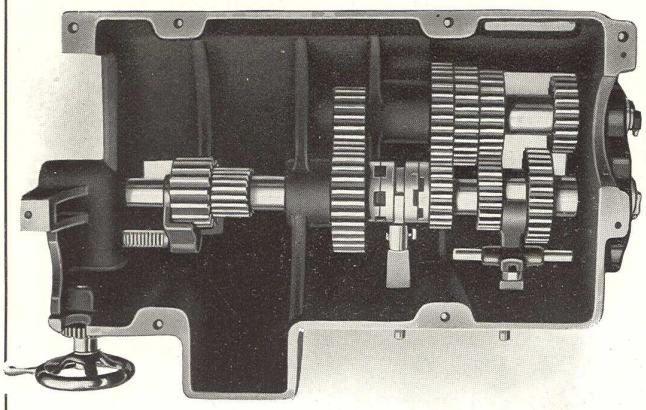
8 Speeds thru Face Plate Drive



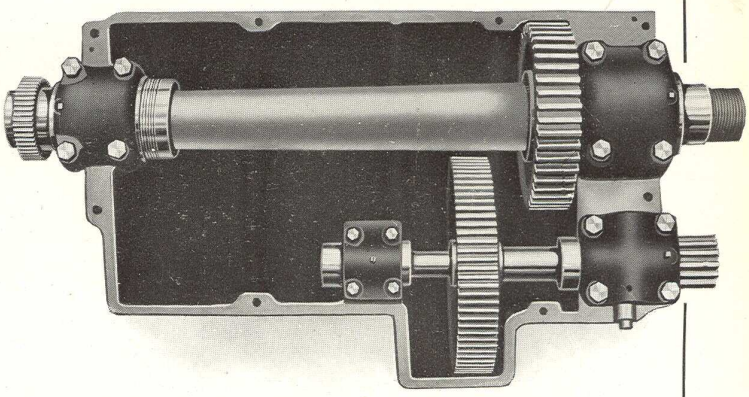
36 and 42-inch "American" High Duty Lathe

Motor Driven thru "Patented" 16-Speed Head

A Constant High Speed Motor is Used



Upper Half of Headstock



Lower Half of Headstock

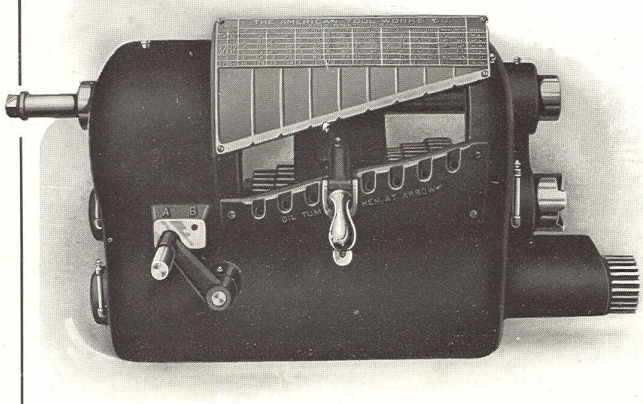
Interior of 36 and 42-inch "Patented" Geared Head

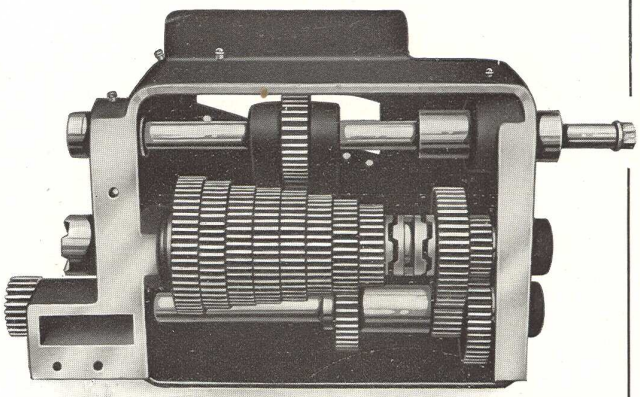
Sixteen (16) spindle speeds are obtained thru this head by the use of only seventeen (17) gears and one positive taper jaw clutch which is easily engaged.

The teeth of the slip gears are machine rounded and readily slide into mesh. 50% of the spindle speeds are obtained thru the face plate drive. This relieves the spindle of a large amount of heavy work, which otherwise would have to be accomplished thru the spindle gear drive.

All loose gears and members have been eliminated from the spindle; the only gear mounted thereon being the spindle driving gear, which is set right against the front bearing. The spindle is therefore relieved from any severe torsional stresses, thus greatly prolonging its life and alignment, and also eliminating the possibility of "chatter."

All bearings throughout the head are bored from the solid and lined with Phosphor Bronze. An efficient oiling system has been developed, which insures the proper distribution of oil at all times. Speeds can be changed instantly.





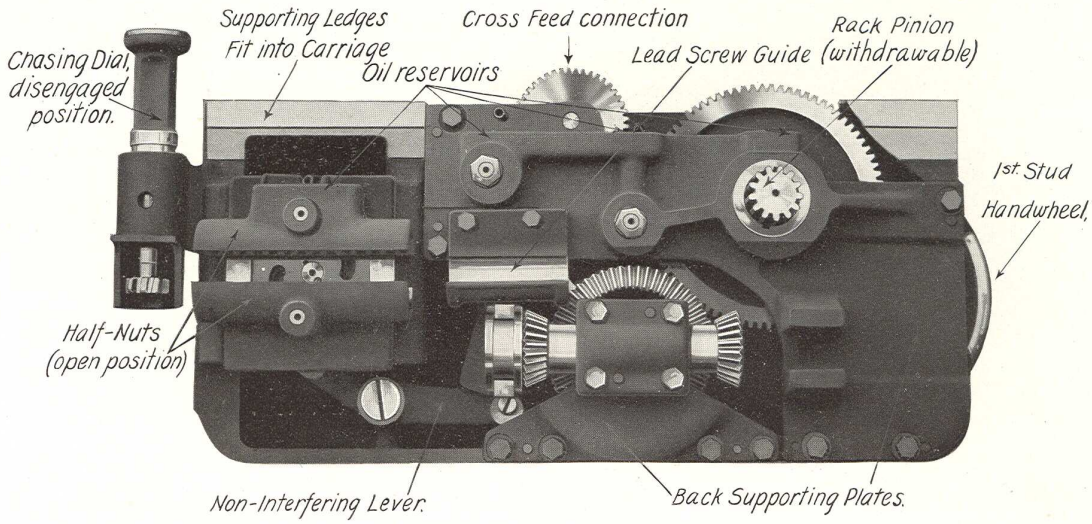
Feeding and Screw Cutting Mechanism of "American" High Duty Lathe

This mechanism provides 48 thread and feed changes, 32 of which are obtained thru the speed-box, the other 16 changes being obtained by means of a compound quadrant gear on the end of bed. The quadrant gear also provides a means of obtaining thru loose change gears any odd or metric threads which might be required from time to time.

The changes in the box are all obtained thru a cone and tumbler gear and two sliding clutches of the selective type. ALL MEMBERS OF THIS BOX ARE STEEL. The cone and tumbler gears are cut with Brown & Sharpe 20 degree involute cutters, which form a tooth pointed at the top and wide at the base. This has proven to be the best possible tooth form to use in a tumbler gear mechanism as the gears can be meshed while running without shock or damage.

Another feature of great merit in this Quick Change Gear Mechanism is that which eliminates the necessity of speeding up the mechanism at any time for any of the different feeds or threads. The coarse threads are all obtained thru the cone and **no member in the box does at any time run faster than the initial driving gear.**

CHANGES CAN BE MADE INSTANTLY WITHOUT SLOWING DOWN THE MACHINE.



All Studs are Supported in the New 24-inch "American" High Duty Lathe Apron

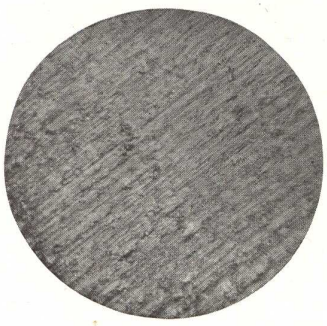
All of the New High Duty Lathe Aprons are of the Double Plate type which affords an outer support for the studs

Note the Oiling System of this Apron

The oil is introduced from the outside of the apron and is lead by means of oil pipes to the reservoirs which are formed in the back plate and which retain a large supply of the lubricant. From here the oil is led thru ducts to the different bearings. Over the opening of each oil duct is placed a piece of felt which both filters the oil and regulates its flow. This permits a continuous lubrication, and prevents the oil from being wasted from flooding and running out of the bearings.

All pinions in these aprons are cut with special cutters from **Bar Steel**; all gears are made from Steel Castings; and all studs are case hardened and ground to size.

This is Why "American" Lathe Beds Will Not Wear Hollow

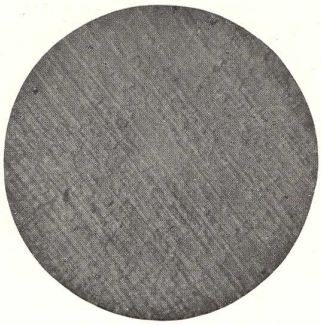


No. 1

Fig. No. 1 shows the surface porosity of a piece of ordinary cast iron, magnified 350 times.

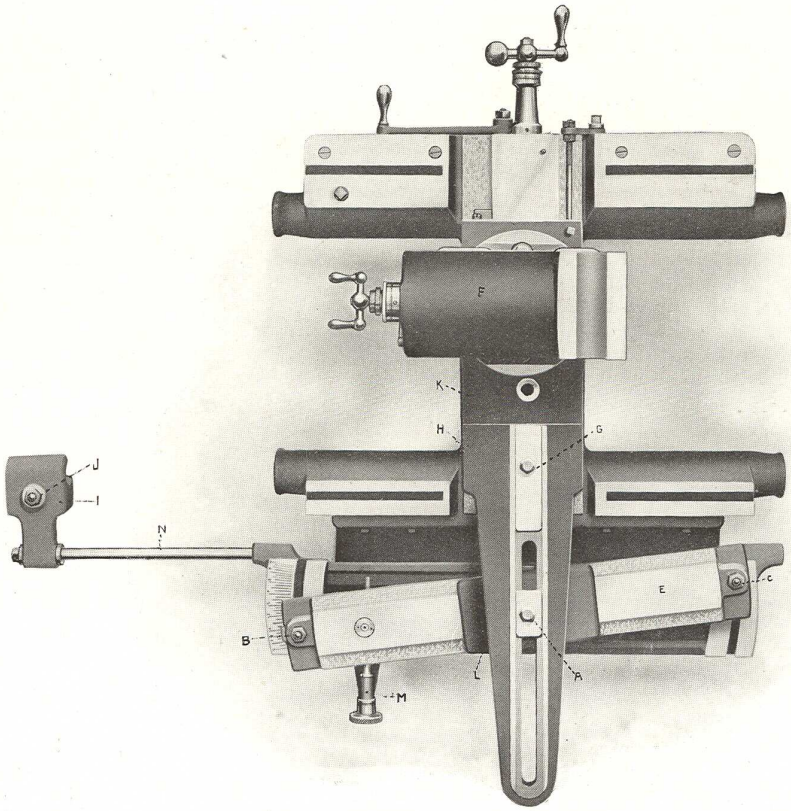
Fig. No. 2, the porosity of a piece of condensed iron such as is used for "American" Lathe beds, same magnification. It is evident at a glance that the iron illustrated by Fig. No. 2 is much denser and closer grained than that shown by Fig. No. 1.

This is one of the secrets of the long and satisfactory service obtained from "American" lathes. The denser and harder a bearing surface the less it will wear under a given load. Naturally, therefore, the condensed iron being denser in structure and considerably harder, offers much greater resistance to wear than a soft or unchilled iron.



No. 2

Another decided advantage offered by this construction is that whatever wear does occur is confined to the carriage where it can be taken up by means of gibs and consequently will not affect the alignment of the lathe. This result is obtained by using an unchilled iron for the carriage bearings, which, being softer than the chilled ways of the bed, will wear instead of the bed bearings.



"American" Taper Attachment

For Lathes 14-inch to 42-inch inclusive

The "American" Taper Attachment, shown above, is both in design and operation extremely simple, the construction being such as to avoid the spring and inconvenience usually found in such attachments. All parts are amply heavy and numerous sliding joints are avoided, thus insuring extreme rigidity and accuracy of tapers produced therefrom.

Bolted to, and traveling with the carriage, it may be instantly thrown into operation or as quickly disengaged at any point along the lathe bed, by means of the binder nut (J) on the clamping dog.

When attached for Taper Work the sliding shoe is directly connected with bottom slide of tool rest by a heavy cast iron yoke, making its operation instantaneous, at the same time doing away with all lost motion, weakness and inaccuracy found in taper attachments directly connected to the cross feed screw.

Cross Feed Nut is always connected with the tool rest, therefore it can not fall to one side and out of position.

Nut for engaging the Sliding Shoe is arranged to slide in the Yoke connected to the tool rest, and is attached to or released from the yoke, as the case may be, by tightening or loosening a single screw.

Accurate Graduations are provided for quickly setting to any desired taper within its range, each graduation indicating ⅛″ taper per foot. In addition there is provided a convenient hand screw with graduated collar which is used for extremely accurate setting.

When Taper Attachment is ordered BEFORE the lathe leaves our works, all work necessary to its application is finished, so that the lathe and attachment reach the customer ready for use, no additional fitting being necessary.

When Taper Attachment is ordered AFTER the lathe leaves our works, it can be readily applied by the user, as all our lathe carriages are drilled to jigs, properly tapped ready to receive the taper attachment, with a slight amount of fitting. Complete information relative to such fitting is furnished by us.

Facts About Metal Planers

Planing is the basis of practically all machine construction, and the quality of the finished product usually depends upon the accuracy of its planed surfaces. Accurate planing can be accomplished only on accurately built Planers, for this type of machine more nearly reproduces the quality of workmanship inherent in itself than any other machine tool. It is evident, therefore, that unusual care must be given to selecting a machine of this kind.

There is really a vast difference in planing machines, which is largely due to the difference in their workmanship. It is a simple matter to build a heavy, powerful Planer, which will plane off a great quantity of metal, but to combine this essential feature with extremely accurate alignments, is an altogether different proposition, because planer alignments are of great length and at right angles to each other, therefore most difficult to obtain.

There is also a decided difference in the class of work produced by different planers. A piece of work planed up on an accurately built machine will be smooth and accurate, while one planed up by an inaccurately built planer will show gear marks, chatter marks and various imperfections. Consequently, when work produced by a planer of the latter type reaches the erecting floor, a great deal of scraping and fitting is necessary, while on the other hand, the work produced by the former type of planer is all ready for assembling, with the exception of the small amount of scraping necessary to remove the loose metal. It is self-evident, therefore, that much time and money can be saved by accurate planing.

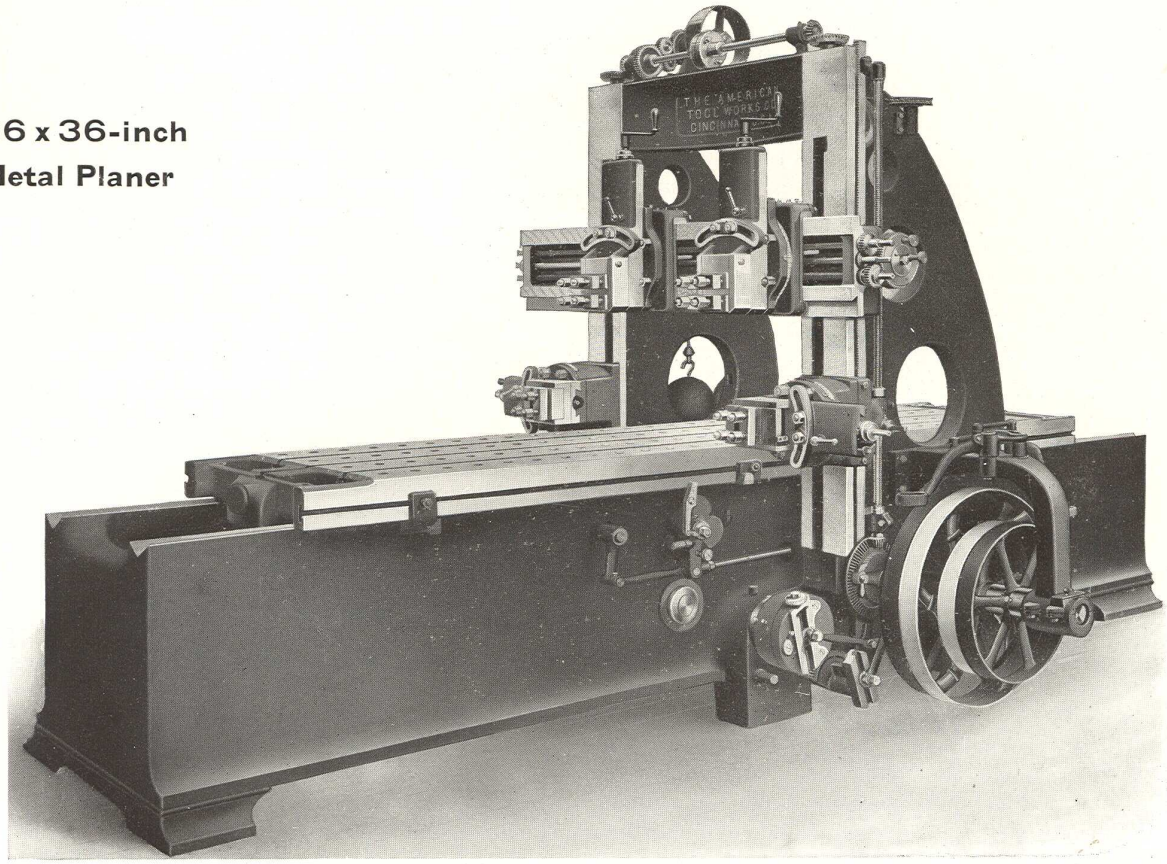
"American" Planers are built in sizes from 22″ to 60″ between the housings. They are erected in a separate department which contains a complete assortment of jigs, straight edges, micrometers, leveling bars, and all other equipment that is essential to the production of highly accurate work. All flat bearing surfaces are tested with surface plates and all shafts and bushings are ground to size. The Vees are scraped wherever necessary, to form a perfectly true bearing surface for the platen, after which the finished cut is taken over the platen in its permanent position on the bed. Every possible care and precaution is taken to produce machines of the very highest quality, and as evidence of the result, we fully guarantee our Planers to plane perfectly square and parallel up to their maximum capacity, within .001 part of an inch.

Aluminum Alloy Driving Pulleys are now being supplied on all sizes of "American" Planers. The Aluminum pulley, by virtue of its lower specific gravity, will develop just about one-third of the momentum that a cast iron pulley of the same dimensions will. Due to this characteristic, the application of the Aluminum Pulley has practically eliminated all over-run of the tables on "American" Planers. In addition the Aluminum Pulley has another decided advantage over the cast iron pulley in that it permits the belts to be used approximately 2 inches longer, which greatly prolongs their usefulness.

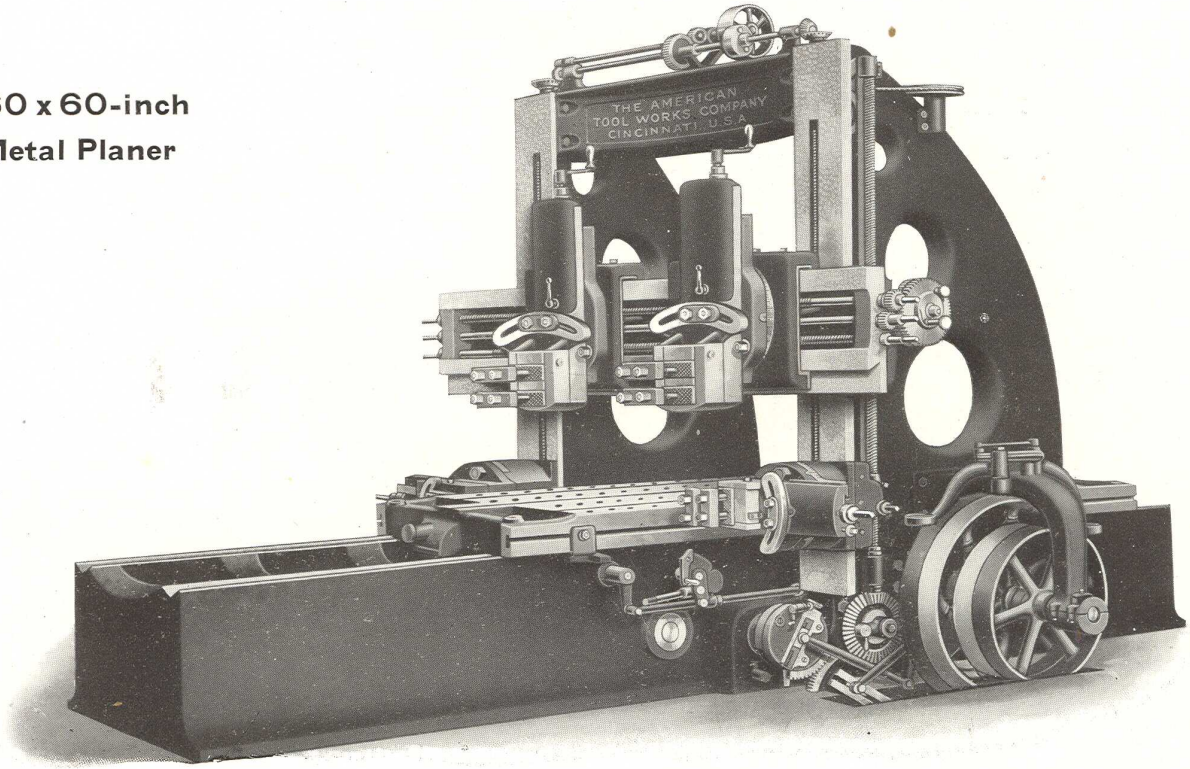
"American" Planers are built in four types; namely, single speed, double speed, quadruple speed and variable speed. The single speed type affords one cutting speed and a constant return speed. This style of drive is especially desirable in shops having a large amount of uniform work, and there is still a great demand for it. The double speed Planer, by means of a special two-speed countershaft, furnishes two cutting speeds and a constant return to the platen. The quadruple speed planer, which is the more universally used of the two multi-speed types, affords four cutting speeds and a constant return speed. The speeds of the latter are obtained thru our "Patented" 4-step Cone Speed Variator, consisting primarily of a pair of opposed 4-step cones, mounted on top of the housings and driven by a wide endless belt. The variable speed type is the very latest in the way of Planer Drives. It consists of a variable speed reversing motor directly connected to the initial driving shaft of the Planer, by means of a coupling. From 30 to 38 cutting and return speeds are provided, which are entirely independent of each other. With this drive, either the cutting or return speed can be changed while the machine is in operation.

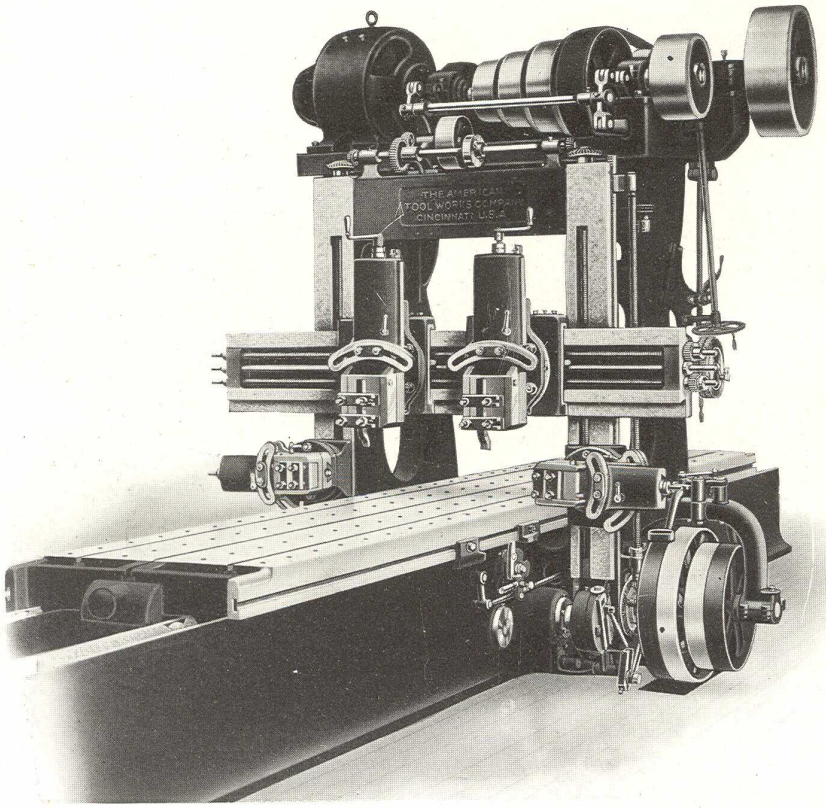
Planers that are not built with the same care that characterizes the building of "American" Planers, are expensive machines to buy at any price. Write us for specifications before installing your next planer.

36 x 36-inch
Metal Planer



60 x 60-inch
Metal Planer

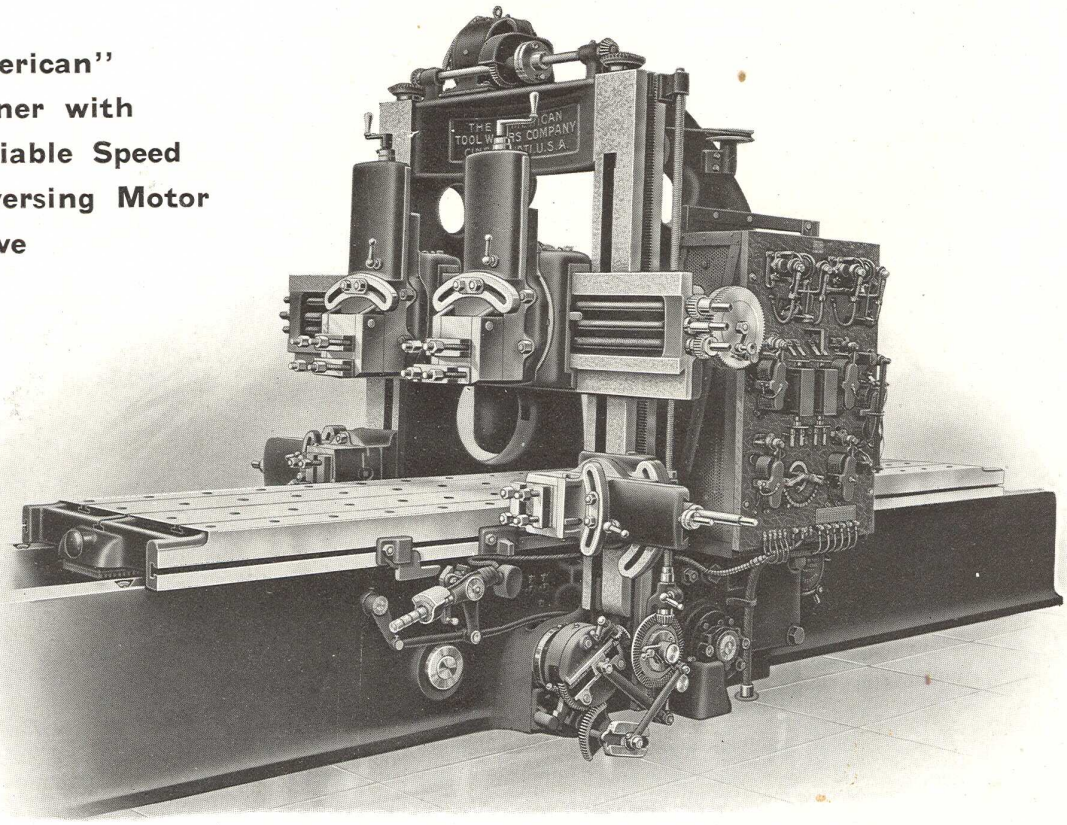


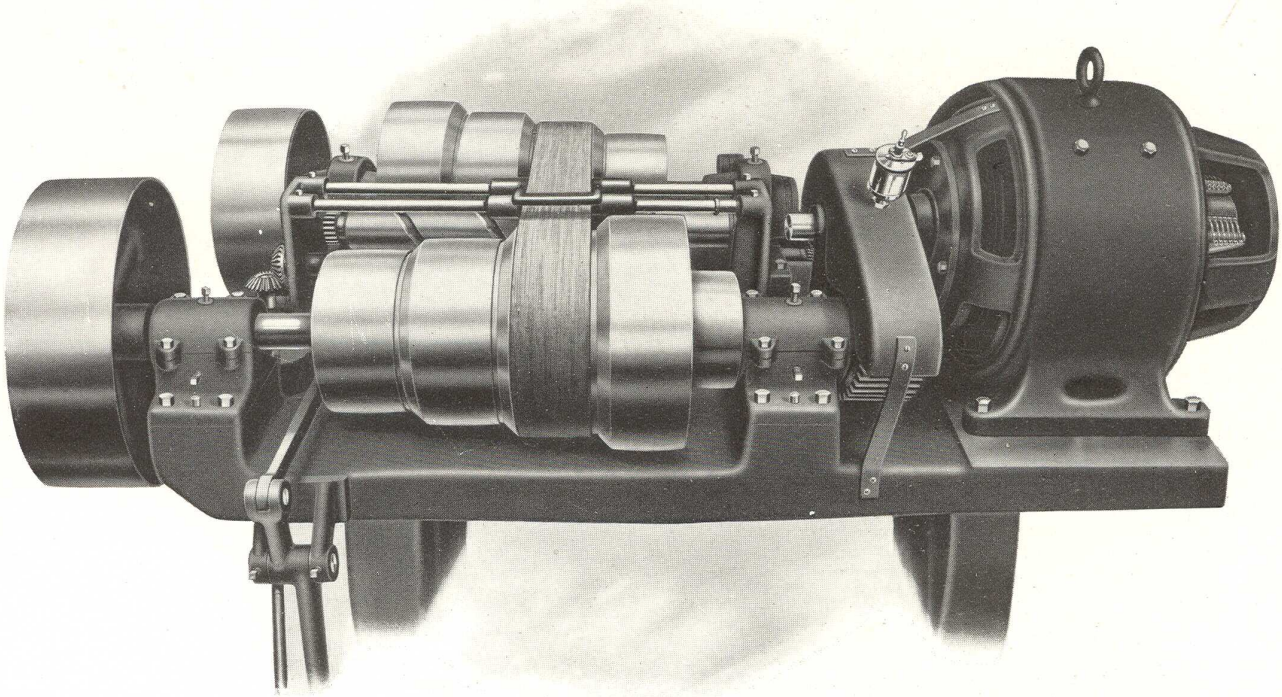


"American"
Multi-Speed
Planer

Motor Driven thru
"Patented" 4-Step
Cone Speed Variator

"American"
Planer with
Variable Speed
Reversing Motor
Drive

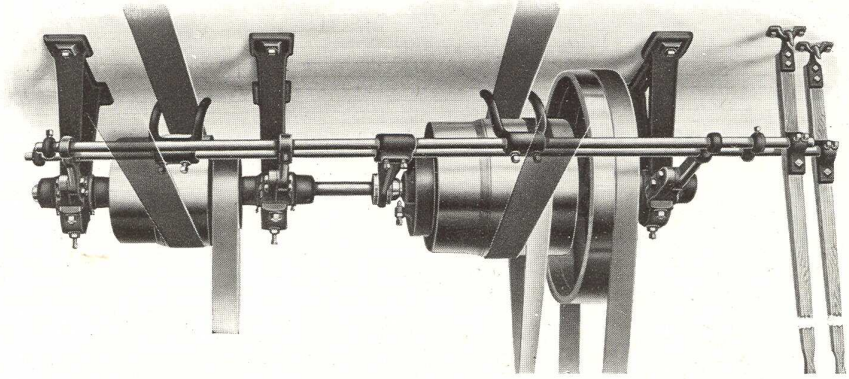




"American" Patented 4-Step Cone, Planer Speed Variator

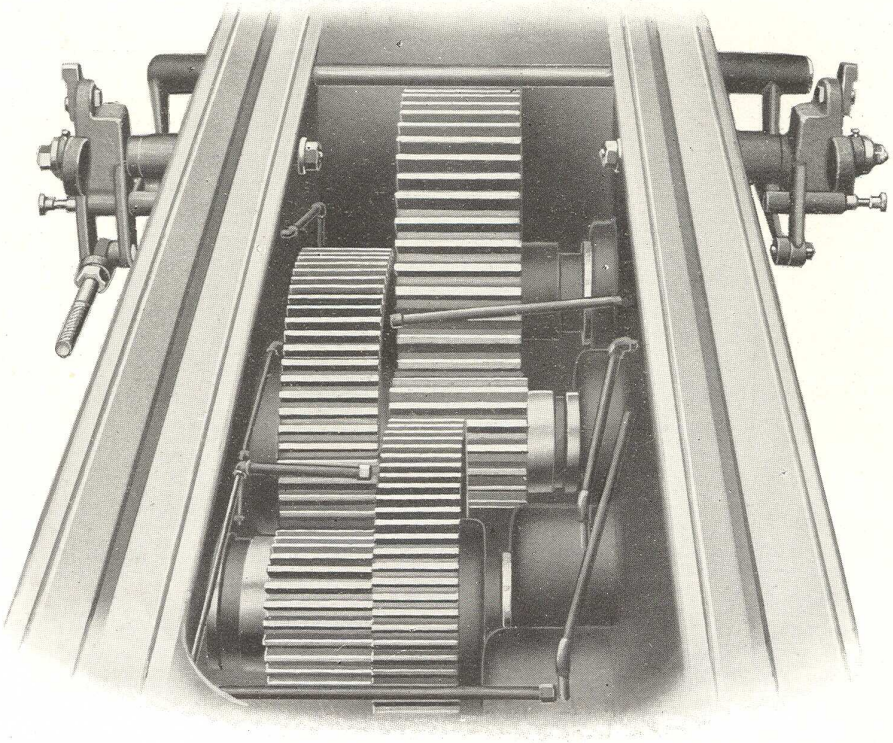
This improved type of Variator provides 4 distinct rates of cutting speed with a constant return speed, the total variation being at a ratio of 2½ to 1. This device is extremely simple in its construction, there being but two cone pulleys and an endless belt involved in its operation. Very efficient means are provided for loosening and shifting the belt from step to step, and provision is also made for quickly obtaining the necessary tension for operating the planer under the usual working conditions. **Any one of the 4 speeds can be obtained in a few seconds time without stopping the machine.** This is accomplished by a conveniently placed handwheel, one revolution of which shifts the belt from one step to the next.

The arrangement is such that the **belt is shifted entirely off the high step of one cone before it is shifted to the mating step of the opposing cone.** This feature, in addition to the loosening of the belt permits rapid shifting with perfect ease and safety. The rises from step to step of the cones are beveled so as to offer no resistance to the passage of the belt. The cones are built up from separate pulleys and are **given a running balance** on a special balancing machine.



Special 2-Speed Countershaft for "American" Planers

Two (2) Cutting Speeds and a constant return speed are obtained thru the above Countershaft, either of the cutting speeds being easily obtainable thru the manipulation of the two levers. This countershaft is unusually substantial, as it consists of very few parts and possesses excellent lubricating facilities.



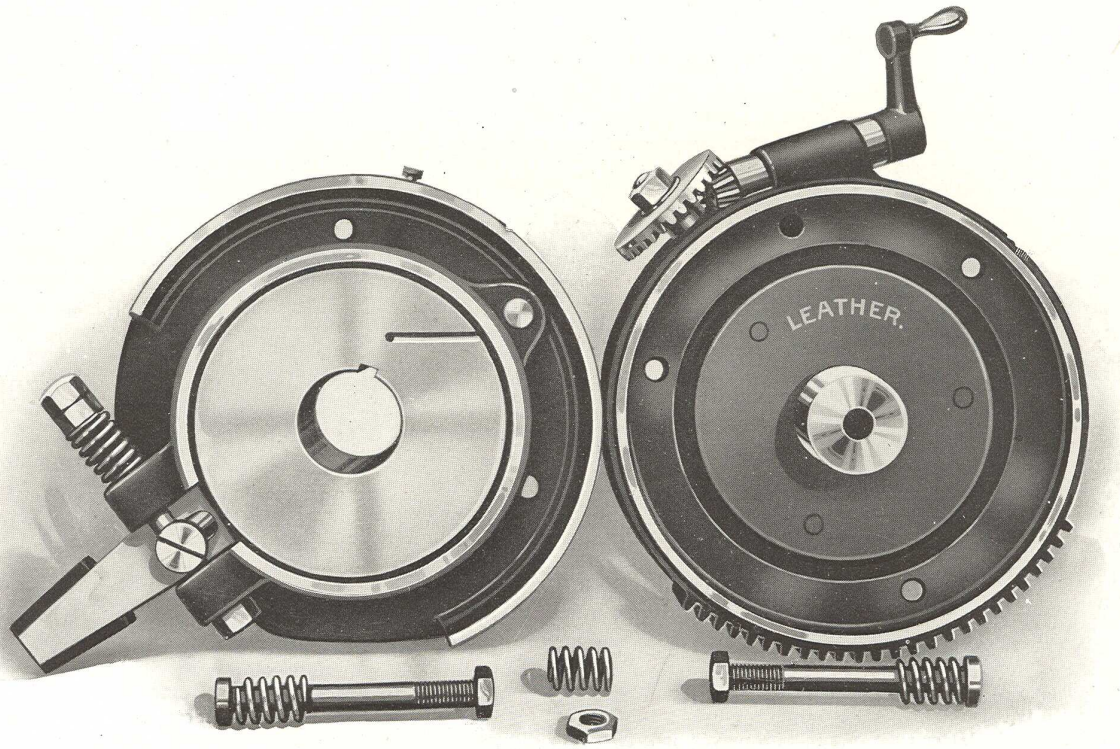
Arrangement of Driving Mechanism in the Bed of "American" 36, 42, 48 and 60-inch Planer

The driving mechanism of "American" Planers is very powerful and is substantially constructed. The Gear ratios and belt widths are considerably in excess of those furnished on many planers, thus providing, with a given table speed, correspondingly greater belt power. THE DRIVING SHAFTS all run in long solid bushings which are accurately ground and fitted bodily into holes bored and reamed in the bed. This method of construction brings the bushings, and their supports in the bed, close up to the driving gears where the greatest stresses are concentrated. There is no overhang between the gears and the bearings. This design affords a construction which is far superior to that frequently used in other makes of planers, in which the bushings are bolted to the outside of the bed by means of flanges—the bearings extending inward thru holes cored in the bed. The section of the bed where the shafts are mounted is strongly reinforced by heavy ribs.

All material entering into the construction of "AMERICAN" PLANERS is of the very best obtainable. The driving shafts are of hammered crucible steel and are accurately ground. The driving pinions are made of high carbon steel forgings and the larger gears from steel castings. They are all cut from the solid with special cutters made for the particular number of teeth in each gear. This method of cutting gears insures a quiet, smooth running drive with a minimum of wear in the gear train.

A very efficient system of lubrication has been developed for oiling this mechanism. The two high speed shafts are bronze bushed, the pulley shaft bearings being supplied with "ring" or dynamo oilers. The bushings for the slower speed shafts are slotted out, and felt wipers inserted, the oil filtering thru the felt from large annular oil chambers in the bushings, insuring a proper distribution of the lubricant. The oiling is done from the outside of the bed, thru gravity oil pipes, which carry a liberal quantity of oil. The capped oil pipes shown in the above halftone supply oil to the gear teeth.

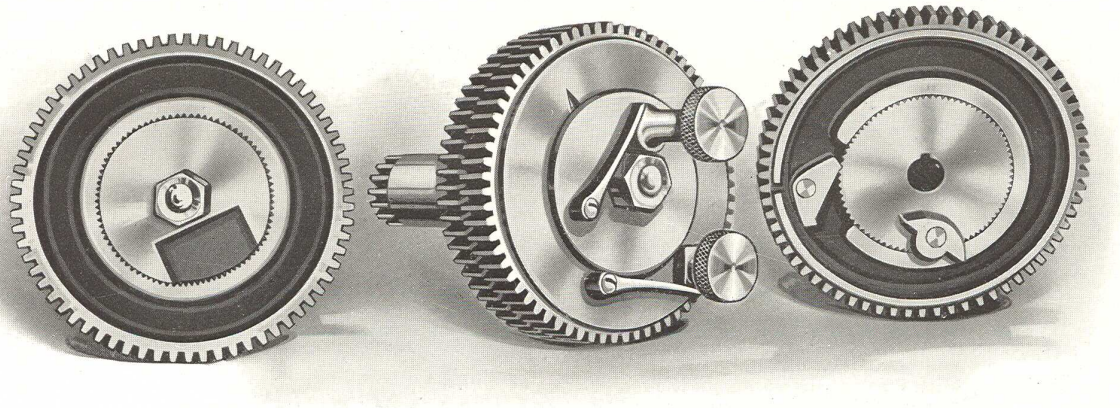
THE LOOSE PULLEYS RUN ON REMOVABLE BABBITT BUSHINGS in which graphite inserts are moulded. These bushings are fitted with felt strips which retain the slight amount of oil necessary; a few drops once a week being all that is required. This style of bushing provides effectually against the leakage of oil (so ruinous to belts) which is characteristic of the usual bronze bushing which is recessed to carry loose oil.



Details of Feed Friction used on all "American" Planers above the 28-inch Size

The Adjusting Gear and Pinion are Used Only on 42-inch Planers and Up

This friction is of an improved type and is very efficient. It is of the combined adjustable band and disc pattern, which provides a much larger frictional area than the plain band type. It will readily pull all heads at the coarsest feed provided. When a left hand side head is supplied an independent friction is furnished for operating it.



Details of Feed Gears

Feeding mechanism is extremely simple and efficient. It is so arranged that the direction of the automatic feed to one rail head is entirely independent of the other.

For Example—This construction used with two heads on cross rail makes it possible to use a rail head for such work as cannot be reached by a side head, as either head may be fed across the rail in either direction, while the other head is being fed up or down.

The above feature is of particular value when no side head is furnished, as it will greatly facilitate the planing of work (with two rail heads) which would otherwise require an additional operation.

Facts About Crank Shapers

Shapers are most advantageously adapted to tool room work, die making and to planing up short work which would otherwise have to be done on a planer or milling machine. For work of this nature, the shaper is far in advance of either the planer or the milling machine, as it is capable of machining this class of work with much greater rapidity than will either of the other two machines mentioned. The class of work handled on a shaper usually requires extreme accuracy and as accurate work can be produced only by accurately built machines, it is evident that unusual care must be given to the construction of these tools.

The department in which "American" Shapers are built is devoted exclusively to their manufacture, and contains all of the manufacturing refinements necessary for the production of accurate work. All flat bearings are scraped to Brown & Sharpe Surface Plates and all cylindrical bearings are ground to size. The utmost care is observed in assembling these machines, and every Shaper, when completed, is thoroughly tested and a record retained of its alignments, none of which are permitted to exceed .001 part of an inch in error.

"American" Crank Shapers are built in the following sizes: 15″, 16″, 20″, 24″ and 28″, all of which, above the 15″ size, are Back Geared.

In addition to their excellent workmanship, our shapers embody many features of value, such as **Full Length Taper Gibs** for all flat bearings, **Patented Feeding Mechanism, Patented Link Connection between the Ram and Rocker Arm, Improved Table Support and Automatic Safety Device for Saddle.**

One of the most interesting features of "American" Shapers and one which is absolutely essential to the life and accuracy of any Shaper, is the use of Full Length Taper Gibs for taking up the wear. These gibs are arranged for end screw adjustment, by means of which a perfect full length bearing can be constantly maintained and the rate of wear kept down to a minimum. The importance of this feature cannot be overestimated, for the rate of depreciation of a machine tool is directly proportionate to the rate of wear in its bearings.

The Full Length Taper Gib undoubtedly affords a more efficient and convenient method of taking up wear than is provided with flat gibs, which require the use of a series of set screws for adjustment. Full length metal to metal contact is impossible with the latter type of gib. Moreover, it is also very difficult to make the necessary adjustment.

With our Full Length Taper Gib construction the degree of accuracy inherent in "American" Shapers positively can be retained thruout the life of the machine, and a full length metal to metal contact is assured at all times.

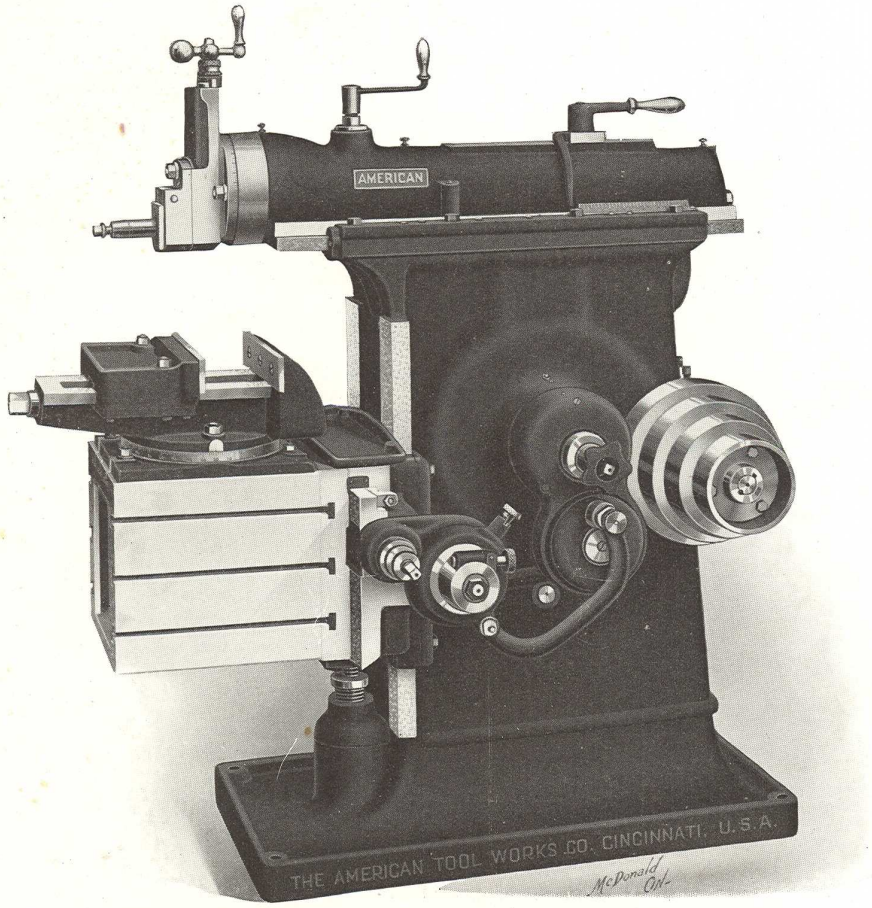
The patented feeding mechanism is absolutely new and possesses advantages common only to its own particular design. It is both automatic and variable, providing a nicely graded range of graduated feeds calculated to suit a wide range of work. The feeds can be changed and accurately set while the machine is running by means of a knurled knob conveniently located for the operator, and after once being set is not affected by changing the location of the rail. The feed is thrown in or out, also reversed through a knob on the feed plunger. The reversal of the feed at the opposite end of the ram stroke is accomplished by a plunger in the face of the swinging gear on the bonnet, which engages either one of two holes in opposite sides of the gear. All parts of the feed mechanism are compact, present a neat and symmetrical appearance, while all the gears in this mechanism are securely covered.

An automatic safety device is provided, the connection between the feed mechanism and cross-feed screw being made by means of a fibre adjustable friction. This forms a "Fool Proof" feature, which will protect the feed works from damage should the tool accidentally be fed into the cut, or the apron be fed into either end of the cross-rail. This fibre friction can be adjusted to pull the heaviest cut without slippage and is not subject to atmospheric conditions, temperature, or the action of oil, as when leather is used.

The Patented Link Connection between the Ram and Rocker Arm is an improvement which can be found only on the "American" Shapers. This connection is made thru a double link which is so constructed as to pull down on the ram during the cutting stroke, thus tending to overcome the upward thrust of the cutting tool The Rocker Arm is rigidly connected to the pivot shaft at the bottom of the column which supports all the weight of the arm and other parts. Consequently, the ram is not required to carry any "dead weight" and a much smoother action is therefore possible as the tendency to vibrate is practically eliminated.

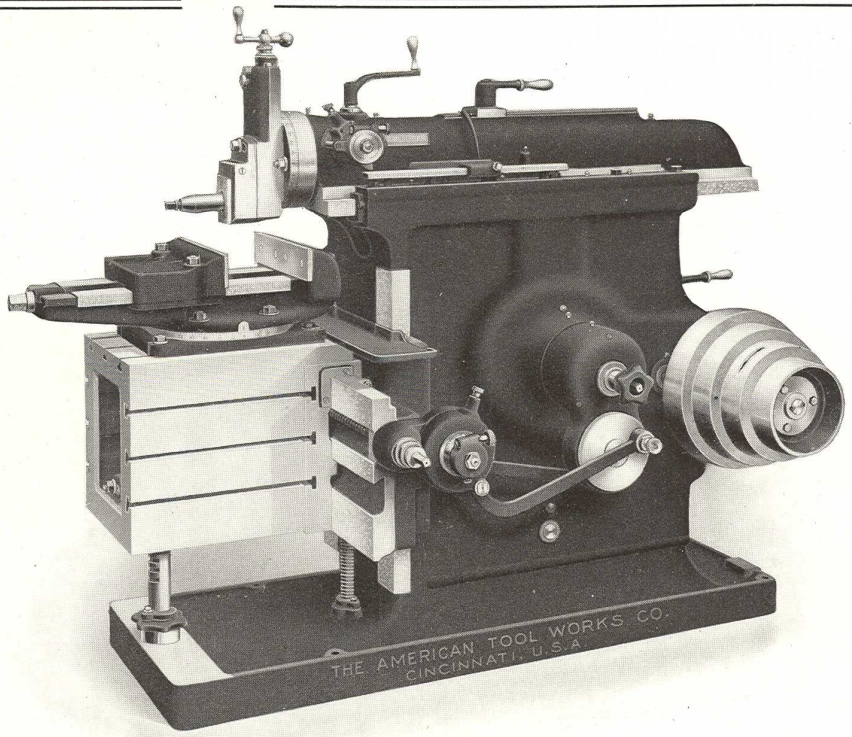
This construction is far superior to that used on other makes of Shapers on which the rocker is attached directly to the ram, the link connection being at the bottom of the rocker arm at the fulcrum point where rigidity is most essential. With this construction the rocker arm also tends to lift the ram during the first half of the stroke, and, moreover, necessitates the ram carrying the "dead weight" of all the parts at all times, which creates more wear on the ram bearings besides consuming more power. This latter design will also cause the work to show all the vibration which takes place in the rocker arm.

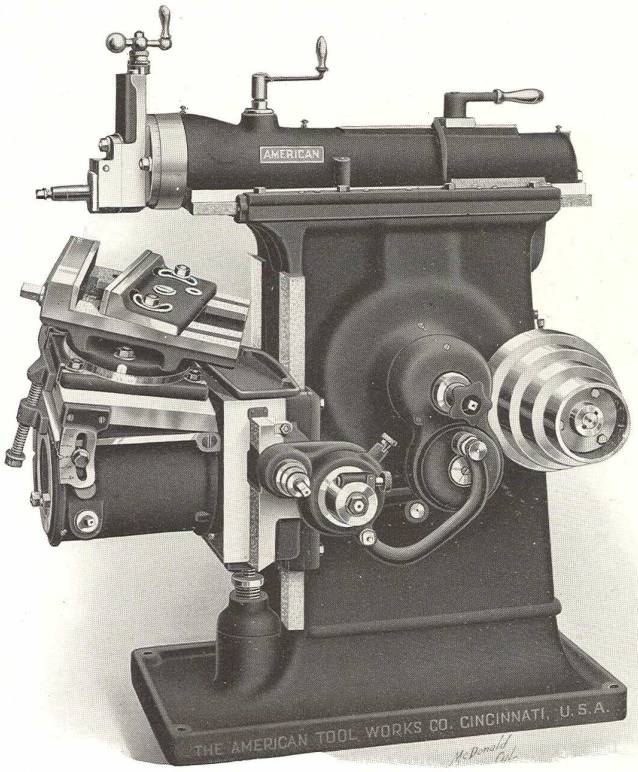
The table support furnished with this shaper is absolutely new in design and represents a radical departure from the designs furnished on other makes. It consists of a notched bar supplied with an adjustable nut at the bottom, and is operative throughout the full traverse of the rail. The notches are spaced 1 inch apart and are enagaged by a spring plunger after the rail has been properly adjusted, any further adjustment necessary being accomplished through the nut at the bottom of the notched bar which bears on the ground surface of the base. This support is rigid and positive and provides the further advantage of relieving the rail of the weight of the table and work, thus insuring a high degree of accuracy in the work produced and less wear on the bearings.



"American"
15-inch
Single Geared
Crank Shaper

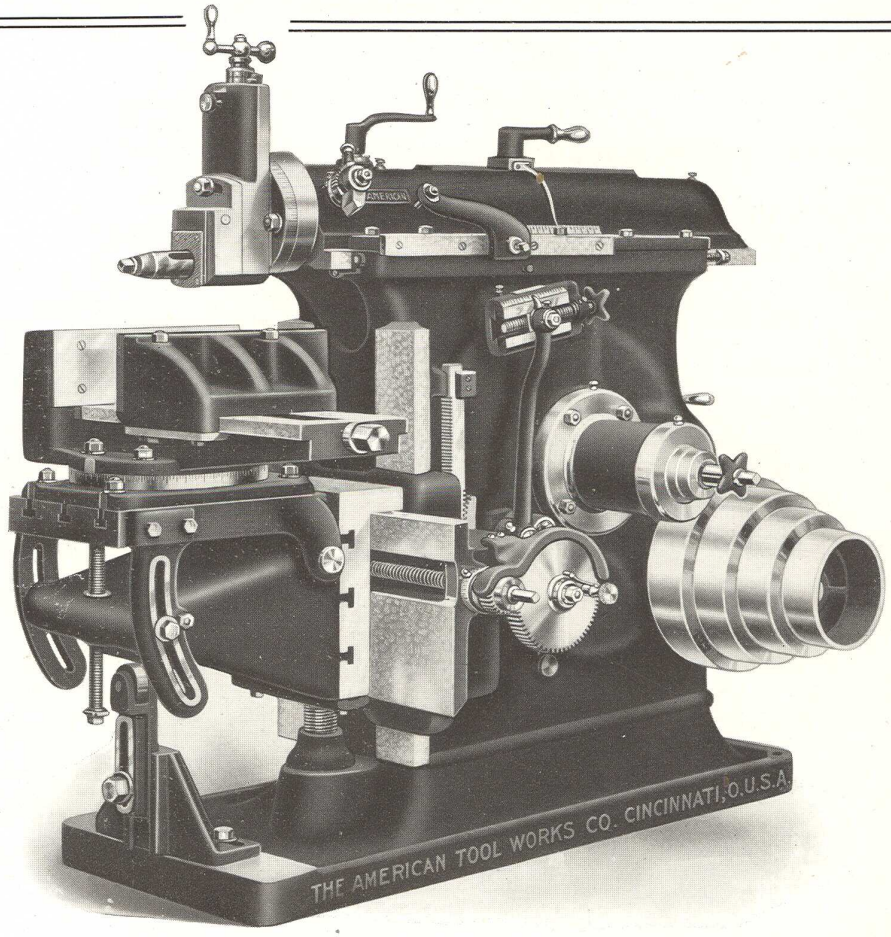
"American"
16, 20, 24 and
28-inch
Back Geared
Crank Shaper

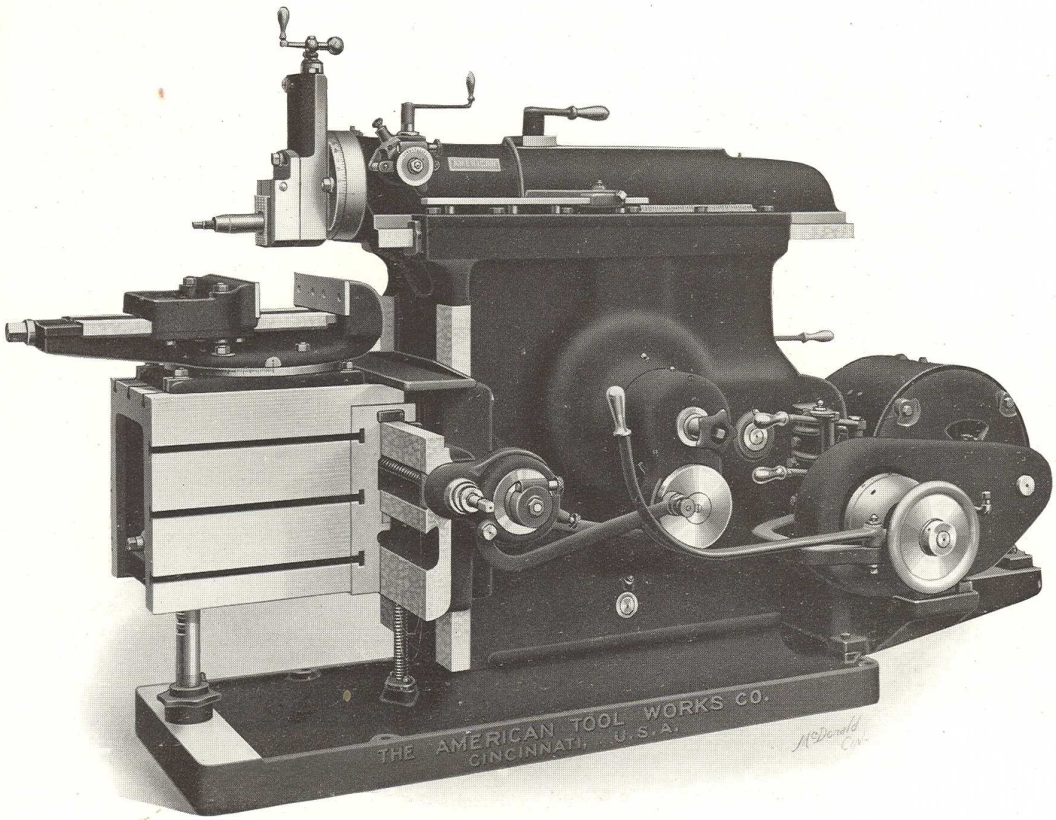




"American"
Crank Shaper
with
Universal Table
and Vise

"American"
Crank Shaper
with
Mold Maker's
Table,
Vise and
Power Down Feed
to Head





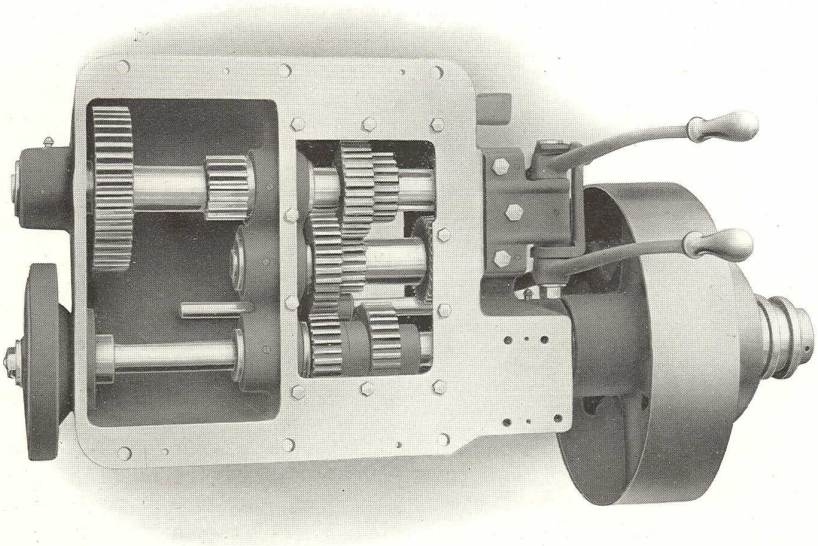
"American" Crank Shaper, Motor Driven thru 4-Speed Box

4-Speed Box Furnished for Either Belt or Motor Drive

The speed changes in the box are accomplished while the machine is running by means of **7 heat treated steel gears,** the teeth of which are machine rounded to facilitate meshing, and two operating levers which are located so the operator can handle them without undue effort. Transmission members run in oil, insuring a quiet drive and long life.

Power is transmitted to the box thru a friction by means of which the machine can be started and stopped independently of the motor or countershaft. A friction brake working in unison with the starting friction provides means for quick stopping. A constant speed motor may be used, as 8 cutting speeds are supplied to the ram thru the 4-speed box in combination with the back gear. Excellent lubricating facilities are provided.

All speed changes can be made instantly while the machine is running.



Facts About Radial Drills

"Drilling Resolves Itself Into the Cost per Hole"

The subject of drilling is one which has received comparatively little attention, although every machine shop uses a Drilling Machine of some sort. The drilling of a hole is, in itself, a very simple matter, but, if you will stop to roughly estimate the number of holes actually drilled in your shop each year, the fact that your drilling is an important matter, will be self-evident. All machine tool operations come under the head of removing metal, and whether it is drilled out, planed or turned off, it is of the same importance. Some time ago we estimated the number of holes drilled in our shop each year and found to our amazement that the number approximated 1,000,000. This alone was sufficient to convince us that drilling is as important, in proportion to the time consumed, as any other machine operation, and therefore if the Drilling Department is not properly equipped, the cost of drilling holes becomes a serious matter. Time saved on a drilling operation has the same proportionate value as that on any other operation. Therefore it will pay you to keep your Drilling Equipment up to the highest possible point of efficiency.

In view of this fact, we would recommend to your careful consideration the following with reference to our line of High Speed Radial Drilling Machines. These machines are built in 2′-2½′-3′-3½′-4′-5′-6′-7′ Plain Radial Sizes and 4′-5′-6′ and 7′ Full Universal Radial Sizes. The Smaller Radials, up to and including 3½′ machines, are single back geared, while the larger machines are triple geared. We also build a line of 3′ and 4′ Ball Bearing, High Speed "Sensitive" Radials, all of which are illustrated on the following pages.

The Radial is fast supplanting the large Upright Drill, for reasons which are self-evident. In every respect the Radial is more convenient and will turn out work with greater rapidity than is possible with the Upright. For example—Our 2′ Radial will accommodate even a heavier class of work than the 30″ Upright Drill and is far more convenient to operate. With the Upright, the work must be moved every time a hole is to be drilled, while on the radial this is unnecessary as the work can be clamped to the table and the head moved or the arm swung into the correct position for drilling. Another important fact is that our Radials are regularly furnished with tapping attachment, while on the Upright, this is a feature furnished only at extra cost. In regard to price, our Radials compare very favorably with that of high grade Upright Drills of sufficient size to handle a similar class of work.

"American" Radial Drills are built in a Department devoted exclusively to their production, which contains all of the manufacturing facilities conducive to highly accurate work, including a complete equipment of jigs, surface plates, templates, etc. We produce each month for shipment between 30 and 40 Radials, the number depending upon the sizes of the machines.

In "American" Radials we have embodied many features of great practical value, such as high initial driving power, direct transmission, elimination of loose running gears, low periphery speeds of gears, bronze journals and a highly developed and efficient oiling system.

The successful combination of these features has enabled us to produce machines that are unequaled in all respects for their:

POWER **CONVENIENCE** **SIMPLICITY**

"American" Radials afford greater back gear ratios than any other standard make of Radial Drill. The 4′-5′-6′ and 7′ Plain and Full Universal Radials are triple geared and afford one direct, one reduced and one double-reduced speed. The tapping attachment is carried on the head and forms the connection between the arm shaft and triple gear mechanism. It is operated from the front of the head by means of a lever conveniently located for the operator. The frictions used in this mechanism, on the plain Radial, are of our "Patented" Double Band Type and afford approximately 60% more frictional area than the average single band clutch, while on the Universal Drills a hardened and ground nickle steel band clutch is used.

These frictions are so located that power is transmitted thru them before the speed is reduced thru the triple gear mechanism; consequently, the frictions run at much higher speeds than is possible on such Radials as have either a smaller back gear ratio, or where the speed reductions are made before the power has been transmitted thru the tapping attachment. The double band friction is one of the exclusive features of "American" Radials and a detailed illustration is shown on one of the pages following.

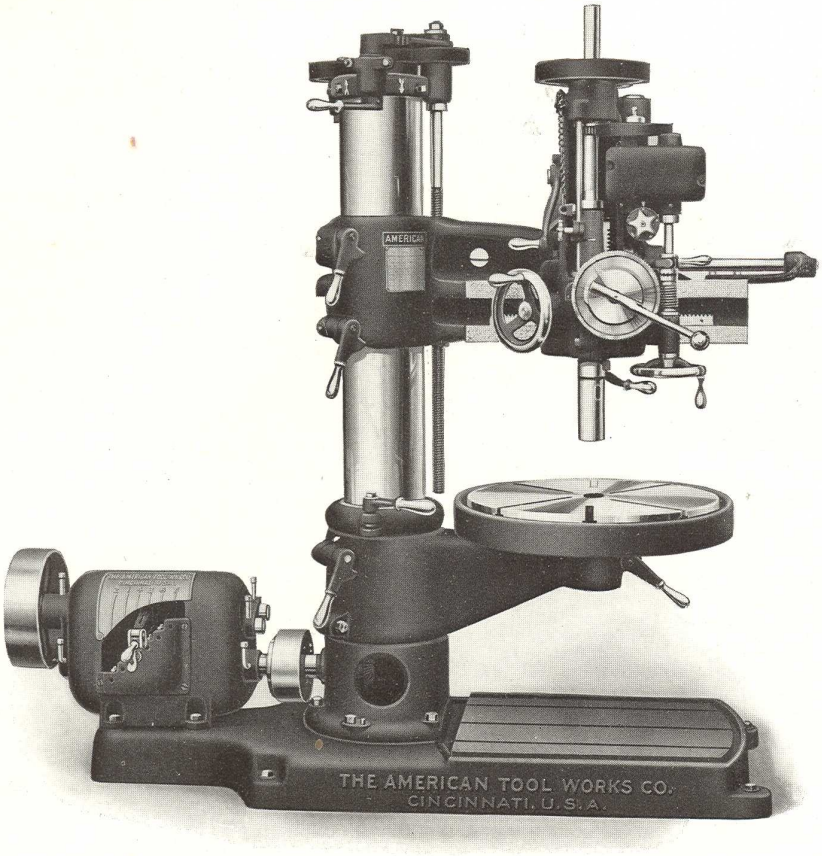
In convenience of operation, "American" Radials are unequaled. Every feature is carefully worked out to enable the operator to manipulate the machine with the greatest convenience and with the least exertion. The tapping attachment lever, which starts, stops and reverses the spindle, and which is therefore used oftener than any other controlling member of the machine, is also located most conveniently for the operator. The feeding mechanism is very simply constructed, and provides eight rates of feed on the triple geared machines and four rates on the smaller sizes. Any one of the feeds can be quickly obtained by merely turning a feed dial until the desired feed, indicated thereon, comes opposite a fixed pointer. The depth gauge always can be set from zero and the automatic stop will accurately trip the feed at any predetermined depth within the range of the spindle traverse. All levers, hand knobs, and controlling members, are conveniently located. This is a very valuable feature, as it not only saves time in manipulation, but saves the strength of the operator; all effort required for the various adjustments being reduced to a minimum.

Simplicity of construction is a distinctive attribute of "American" Radials. In designing these machines, great care was taken to eliminate every possible lever and gear not absolutely needed, and as a consequence, our Radials have no superfluous parts to consume power and to increase the maintenance cost of the machine.

The most conclusive evidence of their extreme simplicity is found in the fact that our triple geared Radials, with speed-box drive, afford 24 spindle speeds by the use of only two (2) levers and thirteen (13) gears in the speed change mechanism. Too much emphasis cannot be placed upon the importance of this factor in Radial Drill construction, and this is a point which should be carefully investigated before placing an order for additional equipment.

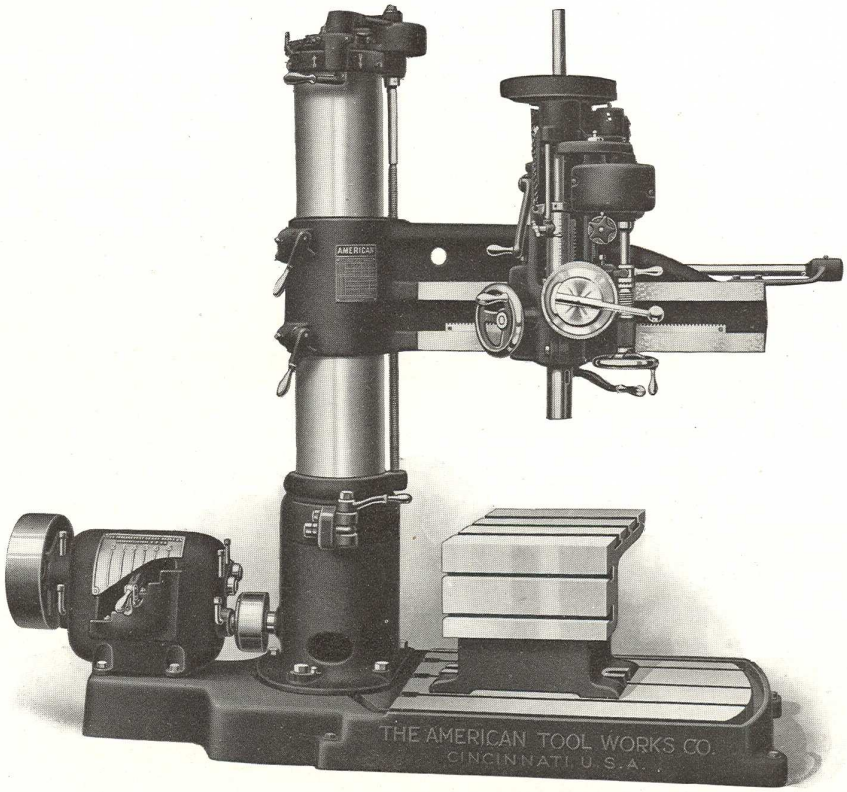
Our Radial Drills are recognized by experienced users as the most productive machines of their kind on the market today.

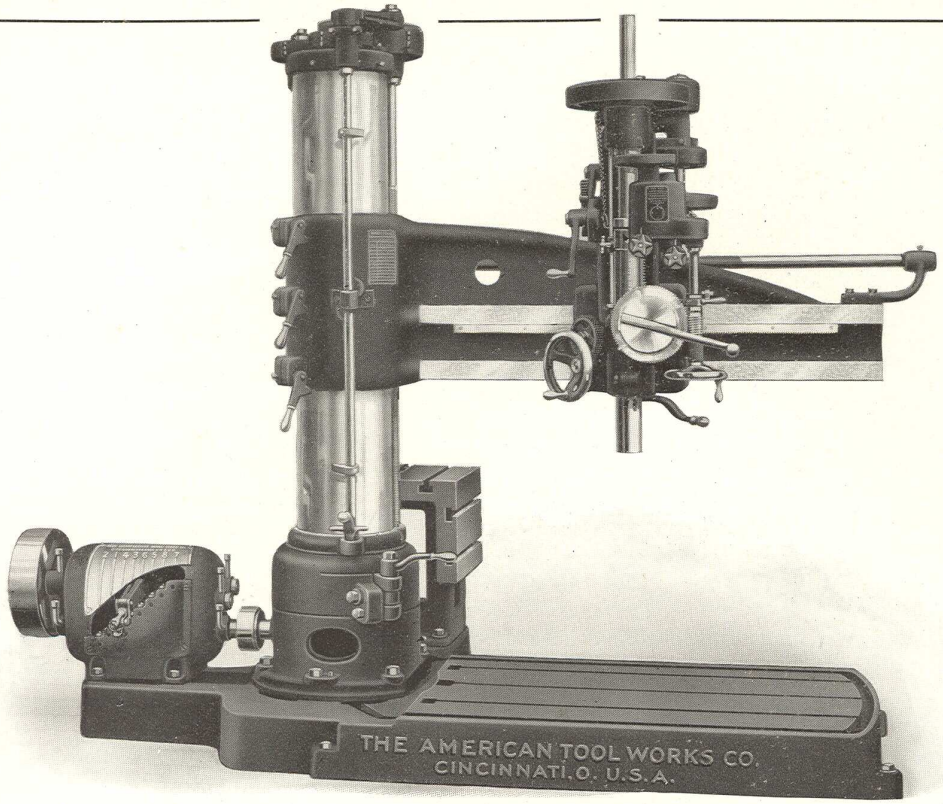
Before placing your next Radial Drill order, we want you to investigate our machines, as we are confident they will give you the same satisfaction that they have given hundreds of other manufacturers. Investigation costs you nothing. Write us for particulars.



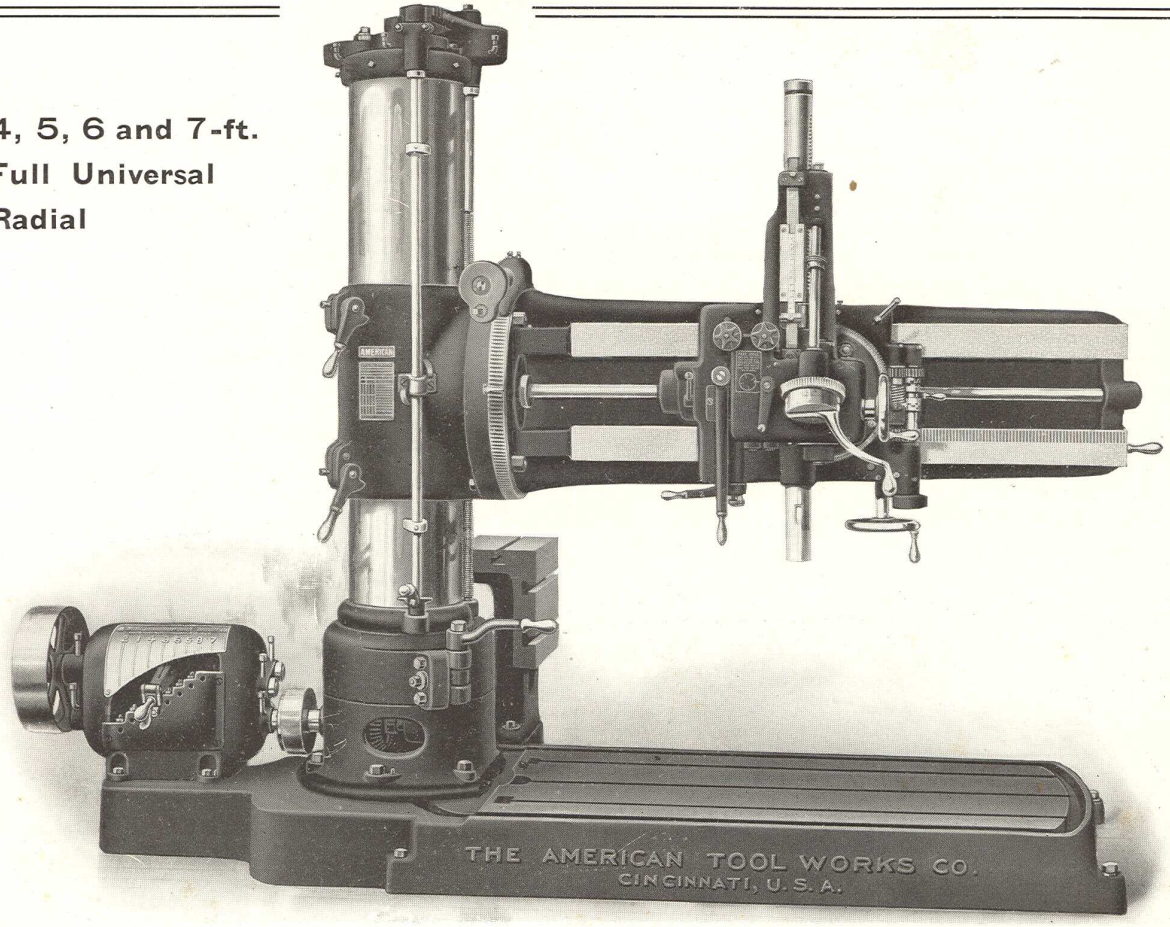
2-ft. High Speed Radial with 6-Change Speed Box

2½, 3 and 3½-ft. High Speed Radial with 6-Change Speed Box arranged for Motor Drive

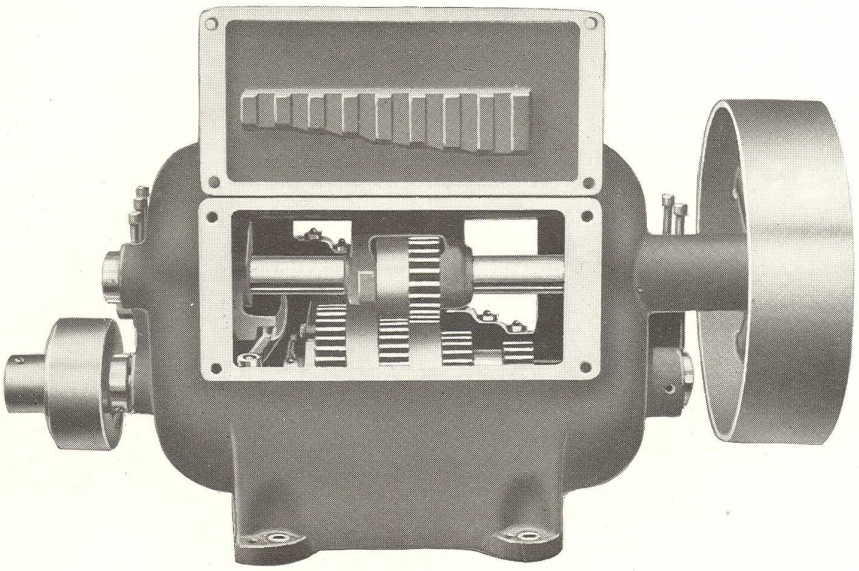




4, 5, 6 and 7-ft.
Triple Geared
Radial



4, 5, 6 and 7-ft.
Full Universal
Radial



8-Speed Box for 4, 5, 6 and 7-foot Plain and Full Universal Radials

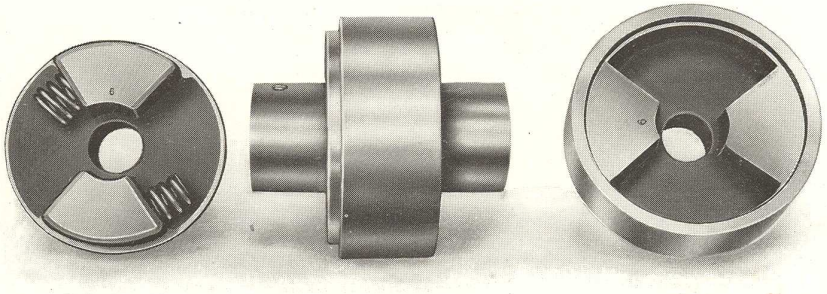
The speed box mechanism is of very simple construction. The speed changes are obtained through a compound tumbler gear, which in connection with four gears on the cone provides 8-speed changes by means of only 7 gears. These changes, in connection with the triple geared head mechanism provide 24 spindle speeds. The speeds may be easily changed without shock to the driving mechanism as the cone gears are kept rotating while changing speeds by means of an auxiliary drive between the pulley and cone shafts which is automatically engaged and disengaged by the raising and lowering of the tumbler lever when changing from one speed to another. This auxiliary drive is certain in its action and operates through a friction clutch which may be adjusted as required. The auxiliary drive is used only in making speed changes.

The tumbler lever is located in its various positions by a notched plate which prevents the gears from being improperly engaged and also prevents the shifting of the tumbler lever until the auxiliary drive is thrown into operation. After the tumbler lever is located it is securely locked in its position by a latch and locking pin, thus preventing destructive vibration and rapid wear of the gears with the subsequent noise and loss of efficiency.

All driving gears are made from a **special grade of steel carbonized and hardened** and are cut with Brown & Sharpe 20 degree involute cutters which form a pointed tooth. This is the only proper and satisfactory tooth to use in a tumbler gear mechanism as it permits engaging the gears without undue shock.

A spring cushion coupling in the line of drive absorbs all shocks and thus insures long life to the driving mechanism.

This type of drive is readily interchangeable with the 4-step cone pulley regularly furnished and an "American" Radial thus equipped can be easily converted into a motor driven machine at any time.



Details of the Spring Shock Absorber which is located in the line of drive between the gear box and the initial driving gears in the column. This mechanism minimizes the possibility of breaking the gears from sudden shocks or strains.

ALL AGREEMENTS MADE SUBJECT TO STRIKES FIRES AND OTHER CAUSES OF DELAY BEYOND OUR CONTROL
WE WILL NOT BE RESPONSIBLE FOR ANY CONTRACT NOT SIGNED BY AN OFFICER OF THE COMPANY

WE ARE NOT IN THE PUMP TRUST

DEAN BROTHERS
STEAM PUMP WORKS
INDIANAPOLIS, IND.

JET AND SURFACE CONDENSERS
VERTICAL ECONOMIC VACUUM PUMPS
STEAM POWER AND ELECTRIC PUMPS
DUPLEX PUMPS SIMPLE PUMPS

July 10, 1911.

American Tool Works Co.

Cincinnati, Ohio.

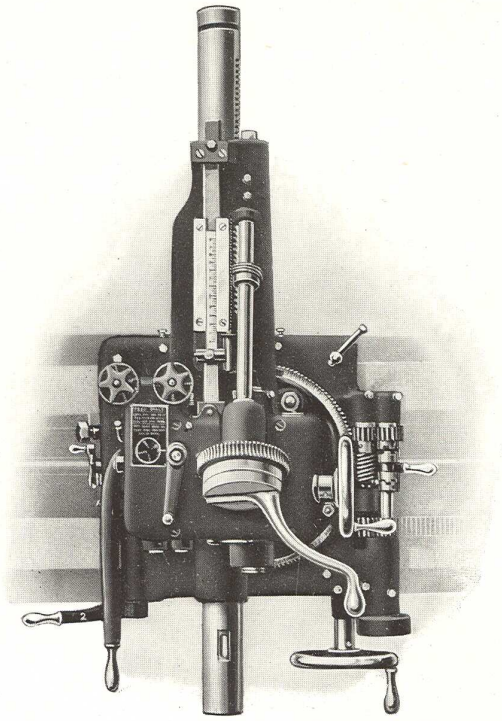
Gentlemen:-

We have made a thorough test of your six foot radial drill and wish to express our satisfaction. It exceeds your guarantee. We herewith enclose photo of the drill at work. In the foreground are the borings from five hours work. The drill in use is a three inch twist drill in solid steel no relief drill is used.

Yours truly,

DEAN BROS. STEAM PUMP WKS.
By John C. Dean.

JCD/CEA



Full Universal Radial Drill Head

THIS HEAD CAN BE ROTATED IN A COMPLETE CIRCLE by means of a worm and worm wheel swiveling device, which is operated by the hand wheel shown at the lower right hand side of the saddle. This hand wheel affords a much quicker and more convenient means of swiveling the head than that provided on other drills, some of which require the use of a socket wrench. The same hand wheel is also used to traverse the head along the arm—a clutch being provided, which permits engaging either the saddle moving or head swiveling device. This clutch can also be set central, thus safeguarding against accidental disturbance of the head when set for angular drilling.

STEEL GEARS ARE USED THRUOUT the machine, with exception of the spindle gear, which is phosphor bronze.

ALL BEARINGS are bored from the solid on Precision Boring Machines, and are BUSHED WITH PHOSPHOR BRONZE. The oiling arrangement is very efficient and is original to "American" Radials, the bushings being fitted with felt oil wipers, which filter and also properly distribute the oil.

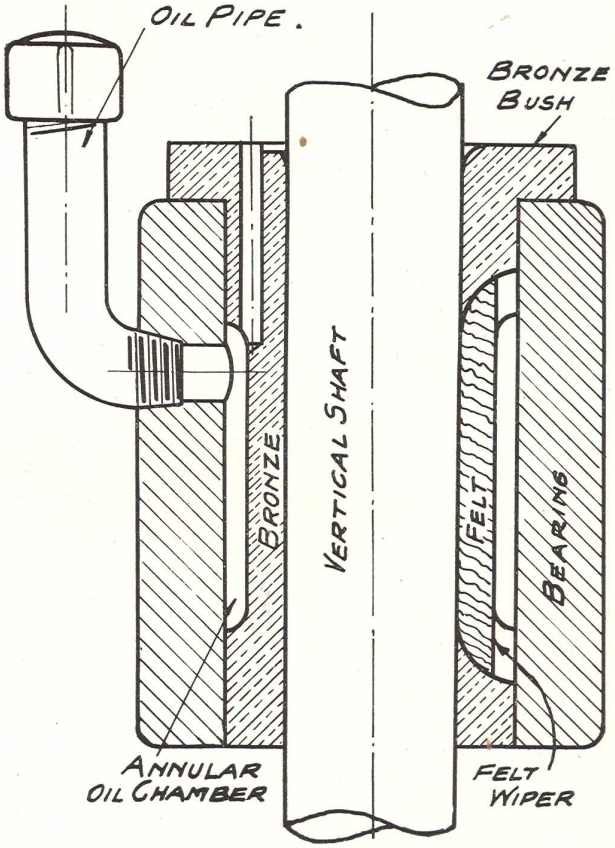
Thorough Lubrication

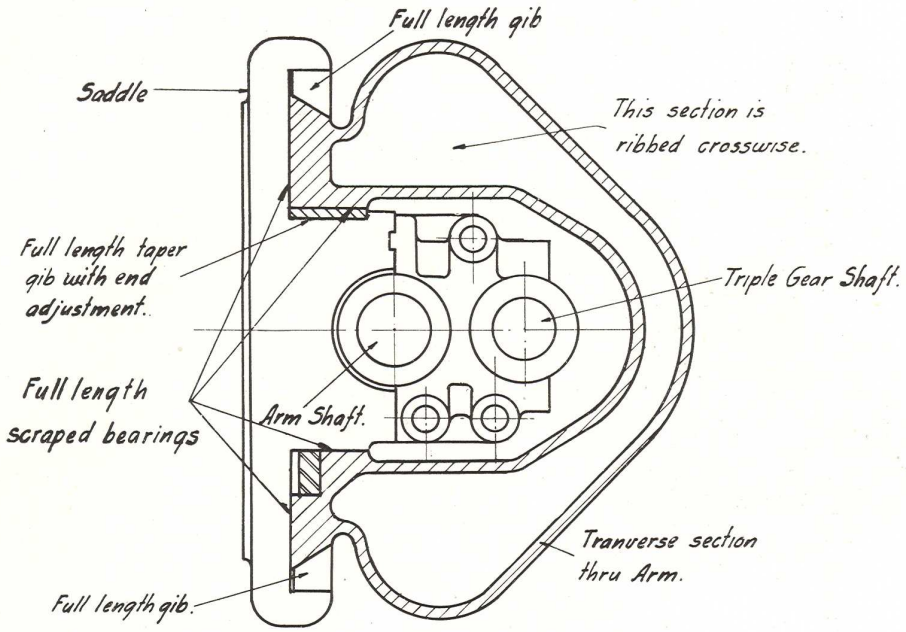
Is essential to the efficient operation of a Radial Drill because of the high speeds at which the shafts run and because the majority of bearings are of the vertical type. On "American" Radials will be found the most efficient oiling system yet devised.

By referring to the accompanying cut it will be noted that the oil is introduced through a pipe, and is led to the annular oil chamber, which retains a large supply of the lubricant.

A strip of felt inserted in a slot cut in the bronze bush filters the oil and distributes it uniformly over the entire bearing.

This unquestionably forms the most efficient construction yet designed, for it insures continuous and uniform lubrication, and prevents all waste from oil running out of the bearing before it has performed its proper function.



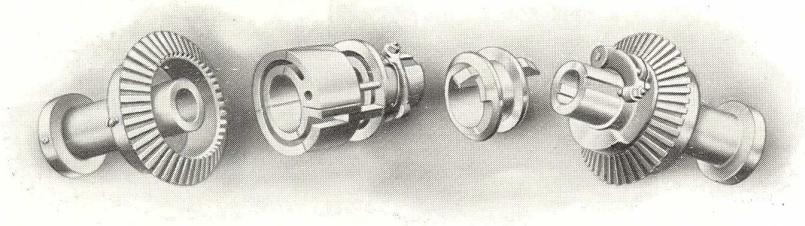


Full Universal Radial

Reinforced Double Section Arm Construction

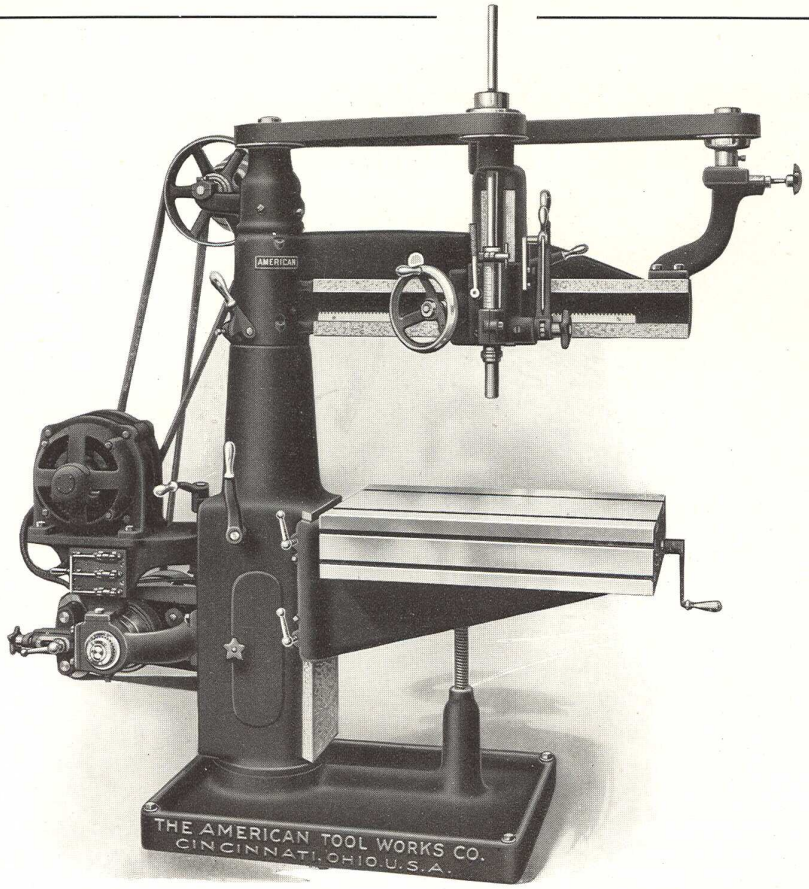
This new type of Universal Radial Arm is made in the form of upper and lower sections which are firmly bound together in the back for their entire length by a double wall of metal and further reinforced by heavy transverse ribbing. The Saddle has exceptionally large bearings on the ways and can be firmly locked at any point along the arm by a clamping device which binds together the arm sections and the saddle into a compact unit; thus all stresses are equally distributed to every part of the arm.

This unquestionably forms the most rigid construction possible for resisting torsional and bending stresses, and we therefore positively guarantee the Arm of the "American" Full Universal Radial to be equally as Rigid as that of any Plain Radial of a corresponding size.



Details of the "Patented" Double Band Frictions used in the Tapping Attachment of "American" Triple Geared Radials

We call especial attention to the construction and action of the Double Band Friction which consists of a combined internal expanding and external contracting band. These bands are carefully ground on a fixture which holds them in their normal expanded position. This method insures a perfect conformity between the clutch ring and the ground contact surfaces of the gear, thus insuring a perfect metal to metal contact when the friction is engaged.



Drills twelve ¾-inch holes thru ½-inch cast iron plate in one minute

COMBINES

the Highest Productive Capacity of the

RADIAL

With the Unquestionable Efficiency of the

SENSITIVE

"American" Sensitive Radials Are Ball Bearing Thruout

Drills twenty ½-inch Holes thru ½-inch cast iron plate in one minute

SPINDLE

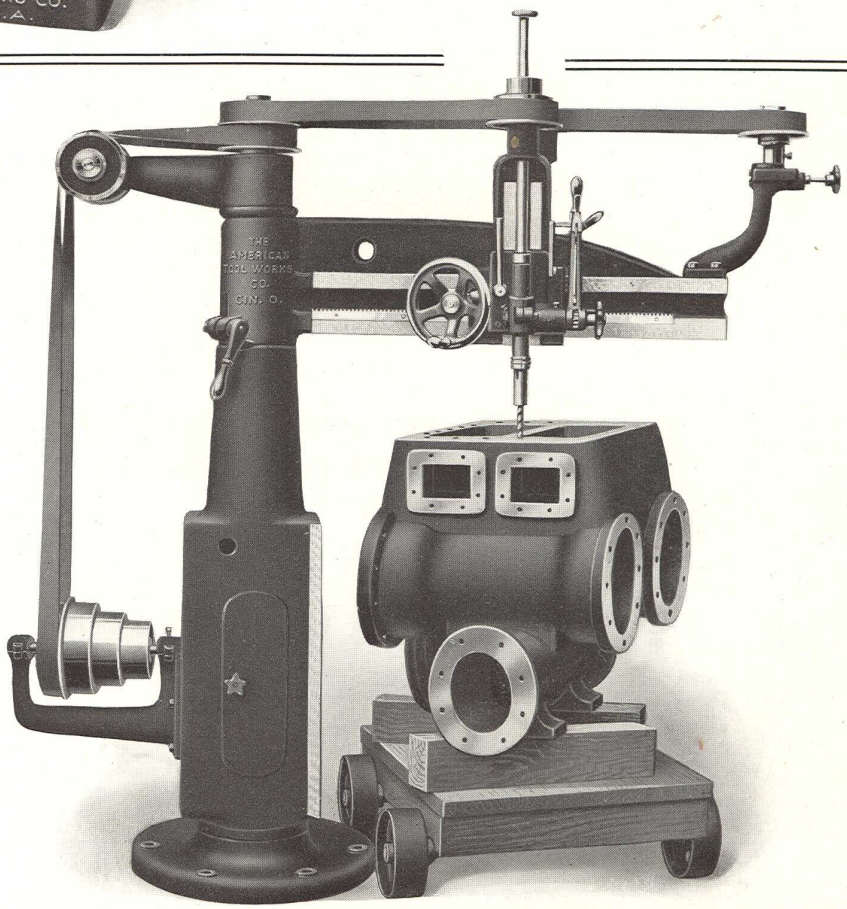
Has Direct Belt Drive — No Gears — Giving

6 SPEEDS

Suited to High Speed Drills Up to ¾-inch Diameter

to run 300 to 1200 R. P. M.

Built with Table in 3-ft. Size, and with Pedestal Base up to 4-ft.



RECORDS OF WORK DONE ON

"AMERICAN" SENSITIVE RADIALS

DIA. OF DRILL	SPEEDS		FEEDS			
	Revolutions Per Minute	Feet Per Minute	Approximate Per Revolution	Inches Per Minute	Net Horse Power	REMARKS
¼″ Carbon	900	59	....	....	.15	Cast Iron 1″ thick.
½″ High Speed	900	137.2	.022″	20	1.5	" " 1″ "
⅝″ High Speed	900	147.2	.013″	12	3.0	" " 1″ "
¾″ High Speed	900	177	.013″	12	3.7	" " 1″ "
1″ High Speed	455	119	.0066″	3	2.6	" " 1″ "
1″ High Speed	785	207	.0076″	6	3.2	" " 1″ "
*½″ High Speed	900	137.2	.037″	16.8	1.2	
†1 19/64″ High Speed	745	248			.9	

*Aluminum engine frame, ½″ thick. Drilled fourteen holes in twenty-five seconds.
†Aluminum case, drilled from the solid. Bosses drilled and faced in one operation.

Note Especially the Performance on Aluminum Engine Frames—14 Holes in 25 Seconds

A Partial List of Automobile Builders Using "American" Sensitive Radials

Buick Motor Co.
Caille Brothers.
J. I. Case T. M. Co.
Chalmers Motor Co.
E. C. Clark Motor Co.
Continental Motor Mfg. Co.
Gray Motor Co.
Hupp Motor Co.
George W. Jagers.
Maxwell Newcastle Mfg. Co.
Moline Automobile Co.
Northway Motor & Mfg. Co.
Packard Motor Car Co.
Parker Motor Co.
Peerless.
Pierce-Arrow Motor Car Co.
Rogers Motor Car Co.
Streator Motor Car Co.
Studebaker Corporation.
Stuyvesant Motor Car Co.
Velie Motor Vehicle Co.
White Co.
Wilcox Motor Car Co.
Willys-Overland Co.

Some Other Manufacturers in Other Lines Using "American" Sensitive Radials

Adamson Machine Co.
American Folding Machine Co.
Atlas Engine Works.
Baldwin Locomotive Works.
Becker Milling Machine Co.
Champion Steel Range Co.
Cleveland Steel Castings Co.
Columbus Die, Tool & Machine Co.
Cutler-Hammer Mfg. Co.
Dean Manufacturing Co.
Dempster Mill Mfg. Co.
Joseph Dick Mfg. Co.
Driggs Seabury Ordnance Corp.
Ferro Machine & Foundry Co.
Gisholt Machine Co.
Halcomb Steel Co.
Kelley Springfield Tire Co.
R. K. LeBlond Machine Tool Co.
Light Inspection Car Co.
Lombard Iron Works.
Morgan & Wright.
National Acme Mfg. Co.
National Cash Register Co.
Potter Johnson Machine Co.
Talmage Mfg. Co.
Westinghouse Electric & Mfg. Co.

THE LIGHTNING DRILL

20 — ½-inch holes thru ½-inch cast iron plate in 1 minute.

12 — ¾-inch holes thru ½-inch cast iron plate in 1 minute.

Pulls a ¾-inch tap.

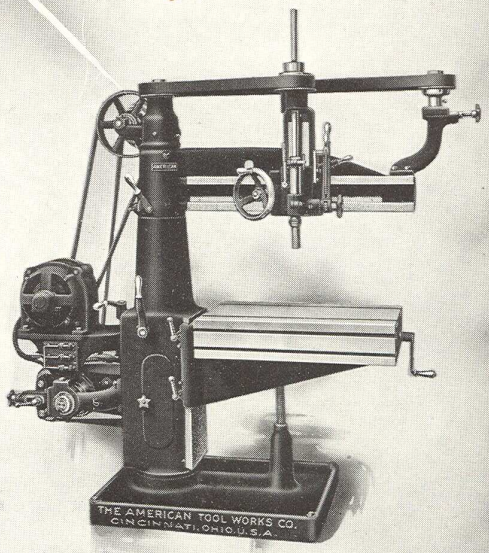
Ball-bearing throughout.

Combines the high productive capacity of the Radial with the unquestionable efficiency of the "Sensitive."

Can be furnished with or without Elevating Table and Tapping Attachment.

Belt or motor driven.

Write for our Lightning Drill Circular which tells how to reduce the cost of drilling small holes.



THE AMERICAN TOOL WORKS CO.

CINCINNATI, U.S.A.

LATHES PLANERS SHAPERS RADIALS

CABLE ADDRESS
ALLYN, WORCESTER
LIEBER'S CODE

CHAS. G. ALLEN CO.

MANUFACTURERS OF

SENSITIVE DRILLING MACHINES

Barre, Mass., U.S.A.

Apr. 8, 1914.

Chandler & Farquhar Co.,

Boston, Mass.

Gentlemen:-

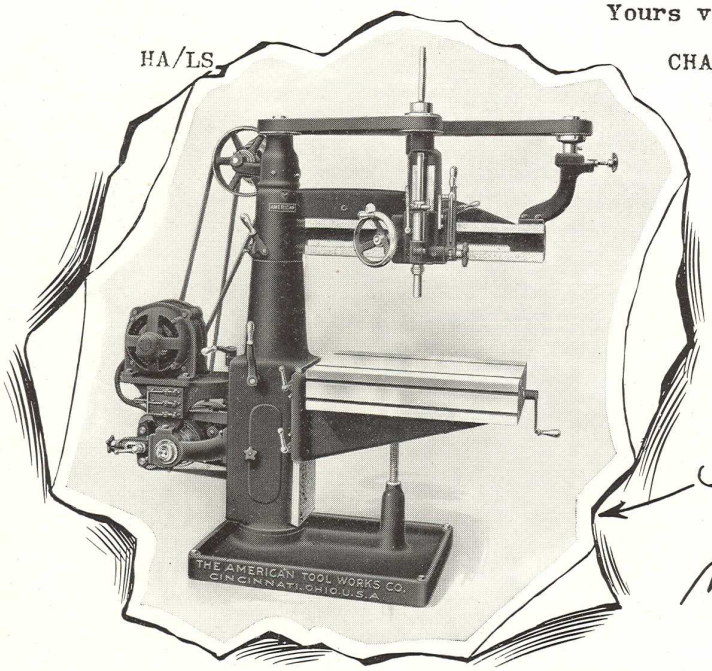
Referring to the American High Speed Ball Bearing Sensitive Radial Drill equipped with Tapping Attachment which we bought from you some time ago, will say that we believe this machine is earning us more money than any tool we ever put in our shop. We are doing all the drilling and tapping on our drill posts with this machine, tapping 3/4" holes easily. We believe you should have a large demand for this machine and are confident that many more manufacturers would use them if they knew what good machines they are.

Yours very truly,

HA/LS

CHAS. G. ALLEN CO.

By Harding Allen



This is the machine referred to

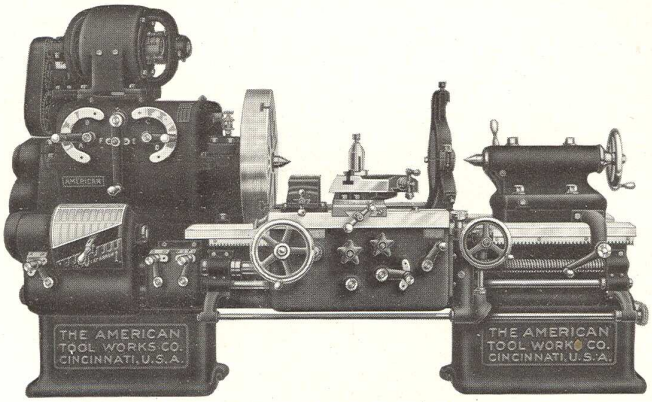
LIFE SIZE

CHIPS

FROM

24" "AMERICAN" LATHE

MOTOR DRIVEN THRU "PATENTED" GEARED HEAD



25 H. P. AT THE TOOL
150 FT. PER MINUTE
945 LBS. REMOVED PER HOUR
STOCK—TOUGH MACHINERY STEEL

THINK IT OVER

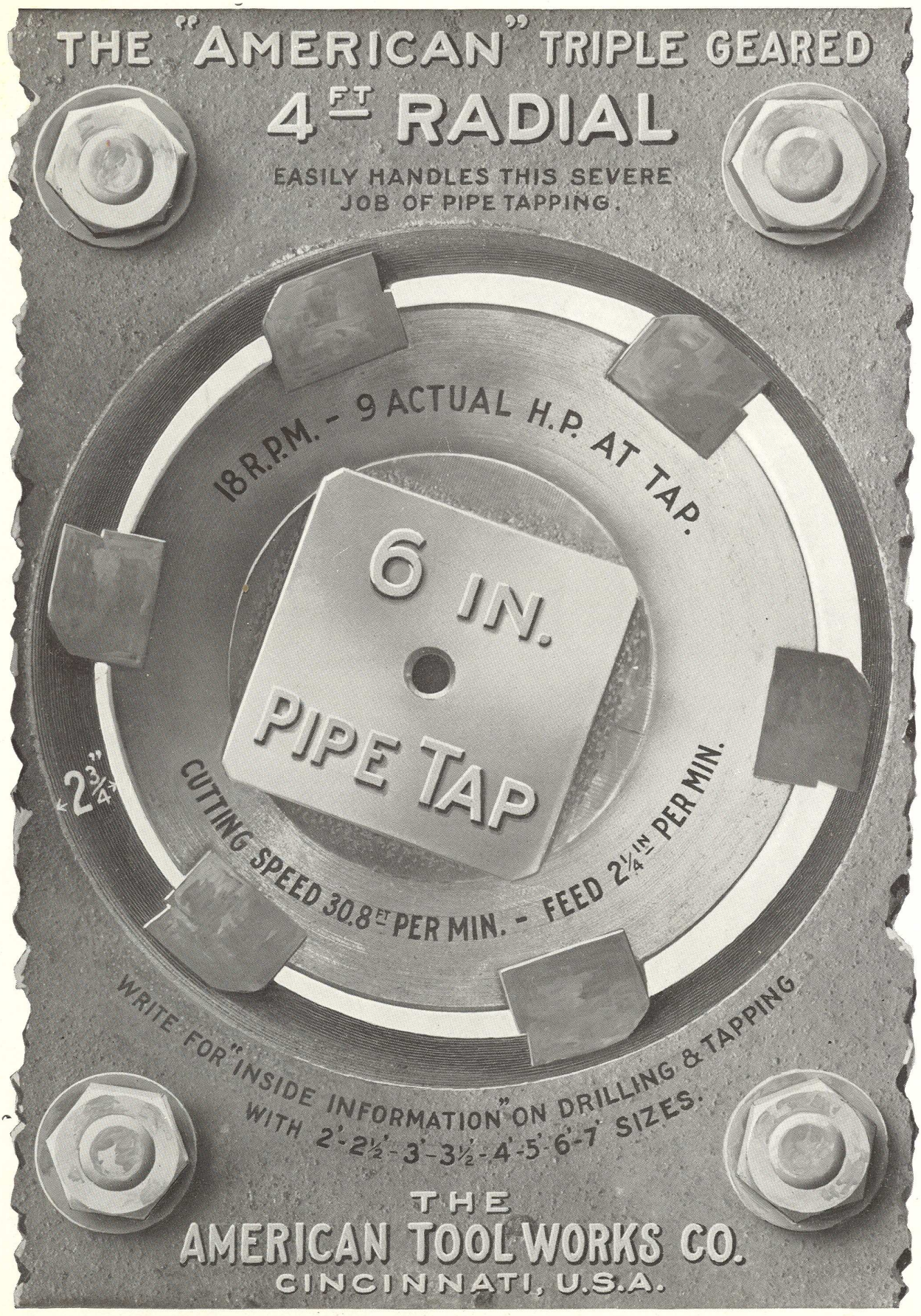
OUR GEARED HEAD LATHES ARE ENDOWED WITH

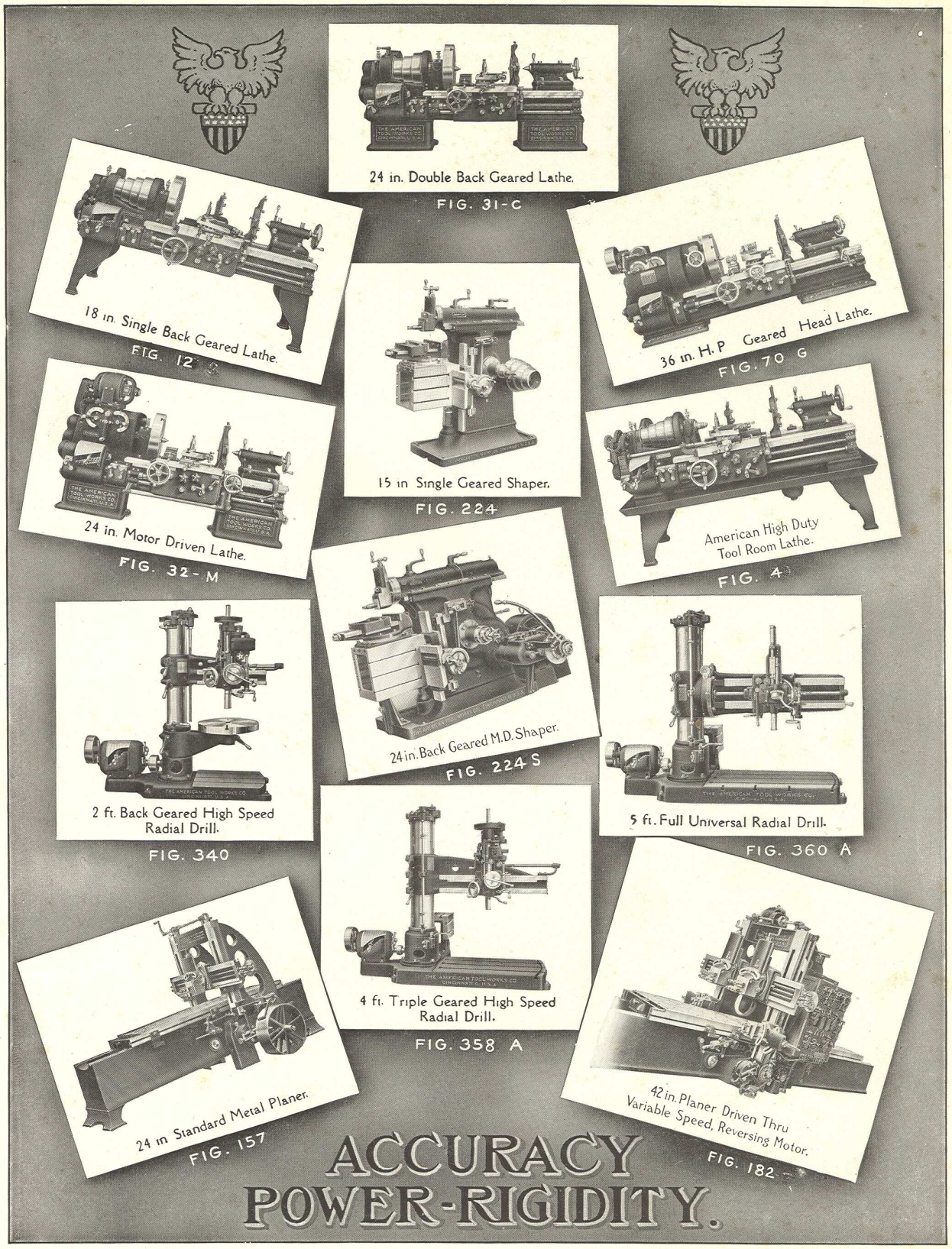
ENORMOUS POWER

ARE BUILT FOR JUST SUCH SERVICE

THE AMERICAN TOOL WORKS CO.

CINCINNATI, O. U.S.A.


THE "AMERICAN" TRIPLE GEARED
4 FT RADIAL
EASILY HANDLES THIS SEVERE JOB OF PIPE TAPPING.
18 R.P.M. - 9 ACTUAL H.P. AT TAP.
6 IN.
PIPE TAP
2 3/4"
CUTTING SPEED 30.8 FT PER MIN. - FEED 2 1/4 IN PER MIN.
WRITE FOR "INSIDE INFORMATION" ON DRILLING & TAPPING
WITH 2'-2½'-3'-3½'-4'-5'-6'-7' SIZES.
THE
AMERICAN TOOL WORKS CO.
CINCINNATI, U.S.A.


24 in. Double Back Geared Lathe.
FIG. 31-C
18 in. Single Back Geared Lathe.
FIG. 12
36 in. H.P Geared Head Lathe.
FIG. 70 G
15 in Single Geared Shaper.
FIG. 224
24 in. Motor Driven Lathe.
FIG. 32-M
American High Duty Tool Room Lathe.
FIG. 4
24 in. Back Geared M.D. Shaper.
FIG. 224 S
2 ft. Back Geared High Speed Radial Drill.
FIG. 340
5 ft. Full Universal Radial Drill.
FIG. 360 A
4 ft. Triple Geared High Speed Radial Drill.
FIG. 358 A
24 in Standard Metal Planer.
FIG. 157
42 in. Planer Driven Thru Variable Speed, Reversing Motor.
FIG. 182
ACCURACY
POWER-RIGIDITY.