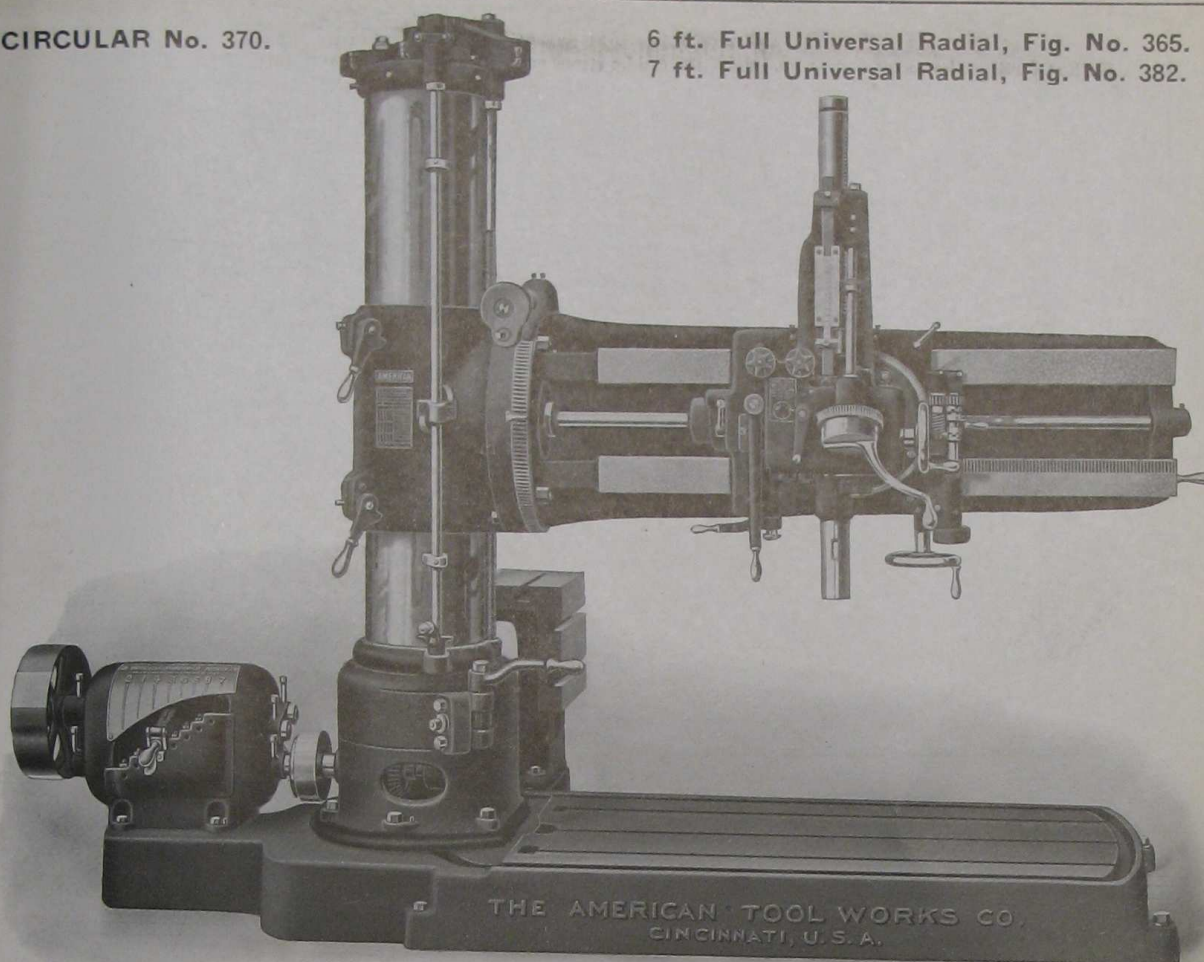


621.95-

CIRCULAR No. 370.

6 ft. Full Universal Radial, Fig. No. 365.
7 ft. Full Universal Radial, Fig. No. 382.



AMERICAN

6 ft. and 7 ft. Triple Geared, Full Universal Radial Drills.

| | 6 ft. | 7 ft. | | 6 ft. | 7 ft. |
|-----------------------------------|----------------------|----------------------|------------------------------------|--------------------|--------------------|
| Greatest Distance from Spindle to | | | Drills to Center of Circle outside | | |
| Base..... | 6' 4 $\frac{1}{4}$ " | 6' 4 $\frac{1}{4}$ " | of Column..... | 12' 3" | 14' 3" |
| Range of Spindle Speeds..... | 19-314 | 19-314 | Traverse of Spindle..... | 20" | 20" |
| Range of Feeds..... | .006—.060 | .006—.060 | Traverse of Head on Arm..... | 51 $\frac{1}{2}$ " | 63 $\frac{1}{2}$ " |
| Morse Taper in Spindle, No..... | 5 | 5 | Traverse of Arm on Column..... | 51 $\frac{1}{2}$ " | 51 $\frac{1}{2}$ " |
| Code Word..... | RIDE | RIOT | | | |

The Universal Radial has heretofore proven entirely inadequate for the severe duty imposed upon the modern plain arm radial, but its field of usefulness in machine shops is so large that a revolution in design was imperative. Up to the present time the Universal Radial has been incapable of driving to the limit high speed steel drills, principally because of lack of power and springing of the arm. The new machine, shown above, represents a radical departure in design and the very highest development in this type of drill, which we unhesitatingly recommend as being capable of fulfilling the most exacting requirements in Power, Rigidity, Durability and Convenience of Operation.

THE AMERICAN TOOL WORKS CO.
LATHES, PLANERS, SHAPERS, RADIAL DRILLS

MAIN OFFICES AND WORKS
CINCINNATI, U. S. A.

4M-B-5-20

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This Radial Drill is the result of long and careful consideration, and in its design we have incorporated the many excellent features of our Plain Radials which have placed them absolutely beyond comparison in their facilities for High Speed Work Production, Accuracy of Alignments and Productive Capacity.

Rigidity of the Arm is doubtless one of the most essential qualities in radial drill design. This, however, is very noticeably lacking in many other makes of Universal Radials, for the reason that either one or more walls of the arm section are cut away in order to incorporate the arm shaft and other transmission elements. This weakening obviously unfits the arm for severe duty and for resisting the combined stresses of torsion and deflection.

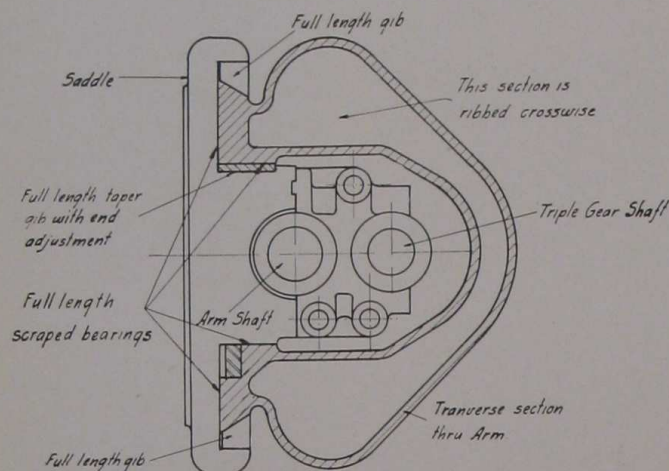


Fig. No. 1. Section thru Universal Arm.

wheel cut in the periphery of the arm flange. This movement, in connection with the swiveling head, permits drilling and tapping at any angle radiating from the center of a sphere, and is firmly clamped as set, by four large binder bolts. Arm is graduated in degrees on its periphery, readings being taken at a fixed pointer.

Head is of very compact design and is equipped with powerful Steel Triple Gears. It may be swiveled through a complete circle by means of a hand wheel and worm which engages a worm wheel fixed to the head. This feature is of special value in setting the spindle for angular drilling. The worm holds the swiveling head in any position, and eliminates all possibility of accident through the head swinging around of its own weight when the clamping bolts are loosened. The hand wheel affords quicker motion than the use of a wrench. Graduations on head show, at a fixed pointer, the angle as set, and three binder bolts are provided for securely clamping the head at any angle. Head is moved rapidly along the arm by means of multiple gearing and rack through the same hand wheel that swivels the head, by simply engaging the clutch shown. A binder is supplied which permits of readily locking the head at any point along the arm.

Saddle Shaft Construction. A feature of great merit is found in the power transmitting elements between the arm shaft and the spindle. The saddle shaft, which forms part of this connection, is offset to one side of the spindle, and is mounted in two (2) long bearings, one of which is integral with the saddle, and the other with the swiveling head. Power is transmitted from the saddle shaft through mitre gears to a shaft in the front of head, from which the spindle is driven through spur gears. This construction eliminates the cramping, consequent loss of power and rapid wear, which is obviously unavoidable in other makes of universal drills where the spindle is driven directly from the arm shaft through bevel gears mounted on each side of an extremely short, single saddle bearing.

Spindle has twenty-four changes of speed, with speed box drive, or cone pulley drive with double friction countershaft, advancing in geometrical progression, ranging from 19 to 314 R. P. M., all immediately available by means of two levers, without stopping the machine. The wide range of speeds obtainable, together with the enormous power and unusual rigidity, render this drill equally efficient when using either the ordinary carbon or high speed twist drills, and particularly fits it for a wide range of tapping requirements. A speed plate fixed to the arm girdle shows at a glance how to obtain suitable speeds for the work being operated upon. Spindle is provided with both hand and power feeds, also with quick advance and return.

Triple Gears are made of steel, are of powerful design, and provide one direct and two reduced speeds through the medium of spur gears and positive clutches. They are operated from the front of the head saddle by a convenient lever, without stopping the machine. Triple gears are mounted on the back of the saddle, and are fully enclosed by the rear walls of the arm, thus permitting the universal arm to be rotated through a complete circle with no possibility of an overhanging mechanism interfering with the work being machined. This is a distinct feature on this drill.

Feeding Mechanism is located on the head, and provides eight (8) distinct rates of positive geared feed, covering a carefully chosen range in geometrical progression from .006" to .060" per revolution of spindle. This mechanism is controlled by

Reinforced Double Section Arm Construction.

The arm design of this new Universal Radial has eliminated every weakness heretofore encountered. It is made in the form of upper and lower tube sections, which are bound together in the back by a double wall of metal, and further re-enforced by heavy transverse ribbing. On the front wall "ways" are formed for carrying the unusually wide and rigid saddle, which is firmly locked at any point along the arm by means of a powerful clamping device. This in addition binds together the double arm sections and saddle into a very compact unit, thus affording unparalleled strength for resisting all strains. Arm is clamped by two binder levers, obviating loose wrenches, and is raised and lowered rapidly by a double thread coarse pitch screw hung on ball bearings, and controlled by a convenient lever, marked ears indicating the proper direction to throw lever for raising or lowering. This lever cannot be operated until slightly raised from its bearing, thus guarding against accident through unintentional movement while the arm is clamped to column. Arm is rotated in a complete circle by worm engaging worm

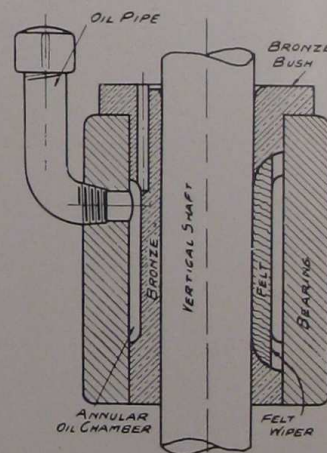


Fig. 2. Oiling Diagram.

two dials, on the face of which the respective feeds are plainly indicated. Any one of the feeds is instantly obtained by merely turning the dial until the desired feed comes opposite a fixed pointer. The rate of feed being used is plainly indicated at all times, and reference to index plates is unnecessary. The feed train is engaged and disengaged at the worm wheel through a Friction Clutch and lever, which lever also controls the quick advance and return of the spindle. This feed friction is so designed as to permit the machine being crowded to the limit of its capacity without unduly straining the feed works.

Depth Gauge and Automatic Trip are of greatly improved and simplified design, and will trip the spindle at any predetermined depth. Readings are taken from zero on a vertical "scale," similar to an ordinary machinist's scale, making unnecessary the reading of a circular gauge. The tripping mechanism is so arranged that the spindle will be tripped at any point within the limit of travel by merely setting the trip dog so that the scale reads the depth to be drilled from zero. This trip acts automatically at the full travel of spindle, thus preventing breakage to feed mechanism. Feed can be tripped by hand at any point.

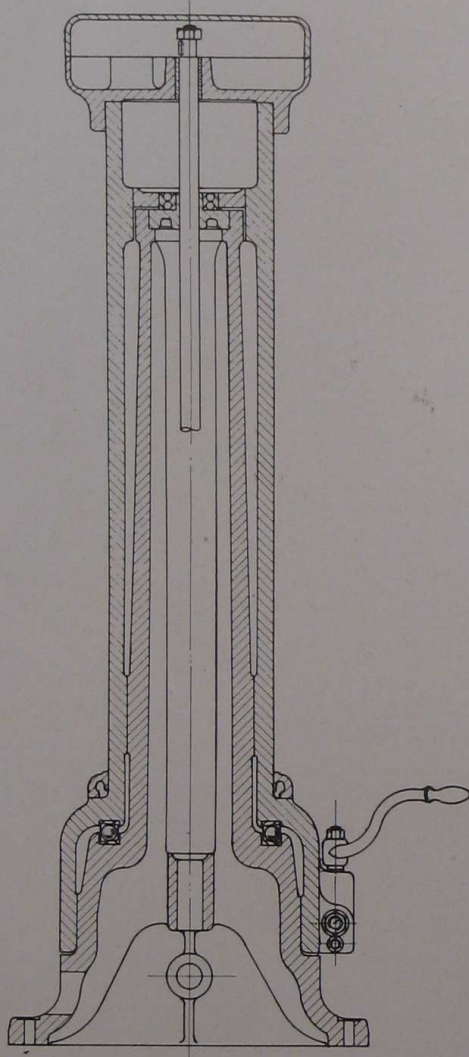


Fig. 3. Cross Section Thru Column.

the bottom. Extensive tests have proven this form of tooth to be far superior to any other for use in a tumbler gear mechanism as it permits of the instantaneous engagement of the gears while running, without danger to the gears, and without "clashing." An auxiliary train of gearing between the pulley and cone shafts is also provided, which is thrown into engagement, through an overtake clutch, by the lifting of the tumbler lever. This rotates the cone gears while changing speeds, and thus permits changes being made without shock to the gears. Tumbler lever and gears are securely located in their various positions by means of a latch and locking pin. A cushion coupling in the line of drive absorbs all shocks, and thus insures long life to the driving mechanism.

Bronze Bearings of the very highest grade are supplied throughout the entire machine, experience having proven phosphor bronze to be the best material available for high speed bearings.

Lubrication. Owing to the high speeds at which the power transmitting members revolve, and also to the fact that the majority of the bearings are of the vertical type, adequate lubrication is one of the most essential features to the successful operation of the machine. The oiling system supplied on "American" Radials is unquestionably of the highest efficiency. The oil

Tapping Mechanism is located in the saddle between the triple gears and the speed box, and is so situated as to afford easy access for any necessary adjustments. The frictions are of unusually large diameter, and run at very high speeds, owing to the high gear ratio, consequently will transmit power far in excess of those used on any other similar size universal radial. Tapping mechanism operates through nickel steel band friction clutches of large diameter. The lever for operating this mechanism is placed on the front of saddle, and controls the starting, stopping and reversing of the spindle. Owing to the fact that the tapping attachment is located between the speed box and triple gears, the frictions, already very powerful, receive the benefit of the triple gear ratio, and have comparatively light duty to perform, thus making possible unusually heavy tapping, without undue strain. Due to the great power of the frictions, they require but a slight adjustment, and the lever operating same is consequently thrown in and out of engagement with a very slight amount of effort.

Column is of the double tubular type providing the equivalent of a double column. The column and column sleeve are both very rigidly constructed, being heavily ribbed on the inside. The column sleeve telescopes the column, and has a bearing at both top and bottom. The sleeve is guided at the top by a high grade ball bearing, while its weight and that of the arm is absorbed by a large ball bearing at the bottom which runs in hardened steel ball races.

Base is of massive proportions, and has unusual depth. Is strongly ribbed lengthwise and transversely, especially at the point where column is bolted. It is planed with the greatest possible accuracy, and has large T-slots with ample allowance of metal around them.

Speed Box is of the cone and tumbler type, and provides eight (8) changes of speed, each one of which is instantly available by the mere shifting of the tumbler lever. All gears in box are made of steel, and are of very coarse pitch and wide face. The cone and tumbler gears are made from a Special Grade of Steel, carbonized and hardened by means of a special process, and are cut with Brown & Sharpe 20 degree involute cutters, which form a very substantial tooth, pointed at the top, and unusually wide at

is introduced thru a gravity oil pipe, and is led to the annular oil chamber formed in the bronze bushings, see illustration Fig. 2. This oil chamber contains a large supply of the lubricant, which is in turn fed to the bearing by means of a strip of felt inserted in a slot cut lengthwise in the bushing. This construction insures a continuous and uniform supply of clean oil being fed to the bearings, and prevents all waste from oil flooding and running out of the bearing before it has performed its function.

Steel Gears are supplied throughout the entire machine. The pinions are regularly cut from the solid bar, while the larger gears are made from steel castings. The cone and tumbler gears in the speed box are carbonized and hardened. All mating spur gears are cut from the solid with special Brown & Sharpe cutters adapted to the particular number of teeth in each gear, and the center distances are tested for accuracy within very close limits on a special gear testing machine. Bevel gears are cut theoretically correct on bevel gear generators, thus insuring a quiet running gear with a minimum of wear.

Countershaft. A single friction countershaft is regularly supplied which provides a speed of 385 R. P. M.

MOTOR DRIVES.

We are prepared to furnish "American" Radials with various methods of electric motor drives.

Motor Drive thru Gear Box. The most popular form of motor drive is that shown by illustration Fig. 4. This consists of either a constant or variable speed motor mounted on an extension to the base, power being transmitted to the gear box by means of three helical gears, this form of gear being used to insure a quiet drive. One of the principal advantages afforded by this type of drive is that, in view of the large number of spindle speeds provided through the speed box and triple gear mechanism, either a direct or alternating current constant speed motor can be successfully used. Should a greater number of spindle speeds be required, a variable speed motor may be used, in which case the number of spindle speeds will be 24 times the number of speeds provided by the motor.

Direct Connected Motor Drive. There is also quite a demand for the style of motor drive shown by illustration Fig. 5. This drive consists of a variable speed motor mounted on the base at rear end of the column, and direct connected to the driving shaft by two spur gears. With this drive the number of spindle speeds provided is three times the number of motor speeds.

The Motor Drives herein described are known as "Standard Motor Drives." Information regarding "special" motor drive applications will be furnished upon request.

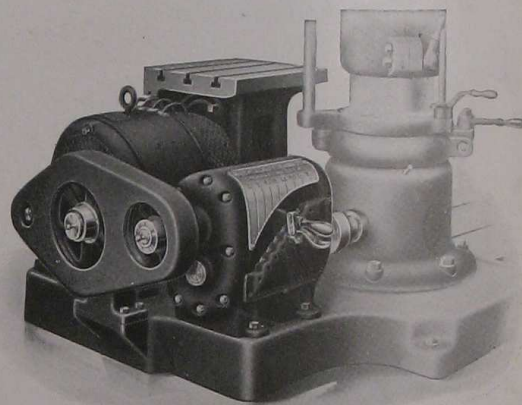


Fig. 4. Constant Speed Motor Drive thru Speed Box.

Plain Box Table regularly furnished has a top surface of 28" x 28" and a side surface of 28" x 18". Both surfaces are accurately planed and are supplied with large "T" slots. Table is mounted on an extension to the base at the side of column, where it will not interfere with the working surface of the base.

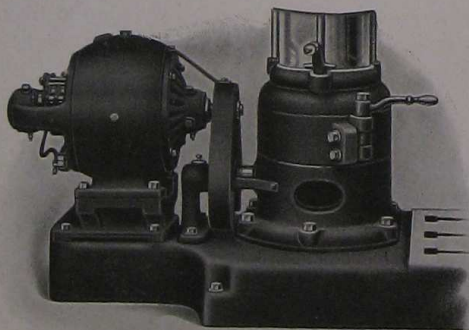


Fig. 5. Variable Speed Direct Connected Motor Drive.

ations on both segment and base show the angle at which the top is set. The table is arranged to be located upon extension to base, but can be used on large base in the same manner as the Plain Box Table.

Regular Equipment upon which base price is determined, includes plain box table, single friction countershaft and gear box belt drive. Instruction book for installing and operating our machines is regularly supplied.

At Extra Cost we can equip this drill with universal table, electric motor drive and Special Bases to suit customer's requirements.

Universal Table. When desired by customer we are prepared to furnish a Universal table per illustration Fig. 6. It consists of a swivel base on which is mounted a housing which carries the tilting top of table. Top can be swiveled to any angle within 90 degrees, and either face can be set in a vertical position by means of a segment and worm. This arrangement, together with a T-handle wrench, makes it very easy to move table when carrying a heavy load. Top can be securely clamped to housing by two bolts, thereby relieving the worm and segment of undue strain, since they are self-locking in themselves. Graduations on both segment and base show the angle at which the top is set. The table is arranged to be located upon extension to base, but can be used on large base in the same manner as the Plain Box Table.

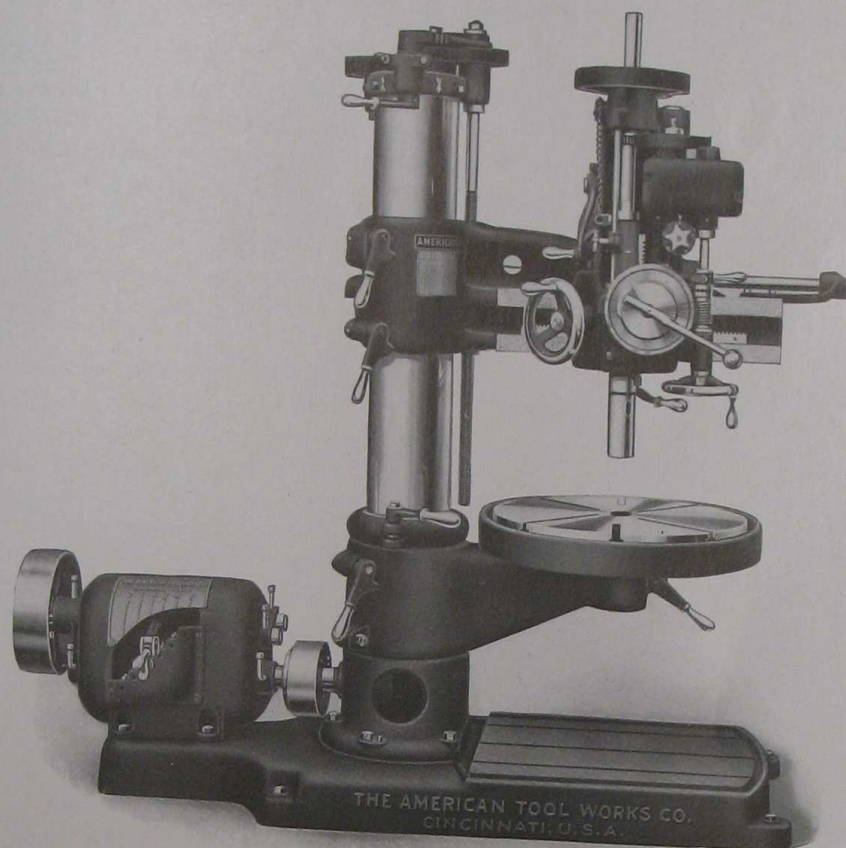


Fig. 6. Universal Table.

621,95

2 Ft. Radial, Fig. No. 340.
 2½ " " " " 341.

CIRCULAR No. 340.



AMERICAN

2 and 2½ ft. High Speed Radial Drills.

| | 2 ft. | 2½ ft. |
|---|-----------|-----------|
| Drills to center of circle outside of column..... | 49 in. | 61 in. |
| Greatest distance from spindle to base..... | 49 in. | 49 in. |
| Traverse of head on arm..... | 16 in. | 22 in. |
| Traverse of spindle..... | 11 in. | 11 in. |
| Range of spindle speeds, cone pulley drive..... | 50 to 600 | 50 to 600 |
| Range of spindle speeds, gear box drive..... | 38 to 600 | 38 to 600 |
| Morse taper in spindle, No..... | 4 | 4 |
| Code word..... | RACE | RASH |

BUILT WITH EITHER CONE PULLEY OR SPEED BOX DRIVE.

"American" Plain Radial Drills combine in an ideal manner all of the advantages of a wide range of speeds, feeds, great driving power and convenience in operating, with a design that is extremely simple, substantial and rigid. The construction of these tools embodies every feature which recent development in machine shop practice has shown to be essential to the rapid and accurate production of drilling and tapping work.

THE AMERICAN TOOL WORKS CO.

LATHES, PLANERS, SHAPERS, RADIAL DRILLS

MAIN OFFICES AND WORKS

CINCINNATI, U. S. A.

Base is very rigidly proportioned, is strongly ribbed both lengthwise and crosswise, and is further re-enforced at the point where the column is supported. "T" slots are accurately planed, leaving ample allowance of metal around them to prevent springing.

Column is of double tubular type. This construction provides the equivalent of a double column and affords unusual rigidity for resisting severe stresses. The sleeve, or outer column, revolves on hardened and ground conical roller bearings, and may be easily swung around and quickly clamped in position by means of our patent "V" clamping ring. This binds the sleeve firmly to the inner column which extends entirely through, and has a full bearing for the sleeve at both the top and bottom.

The Arm is made in a complete tubular section. It is heavily ribbed, and is elevated or lowered by power through a coarse pitch, double thread screw, hung on ball bearings. The elevating mechanism is controlled by means of a lever which is locked in position by means of a plunger, thereby guarding against breakage thru careless handling.

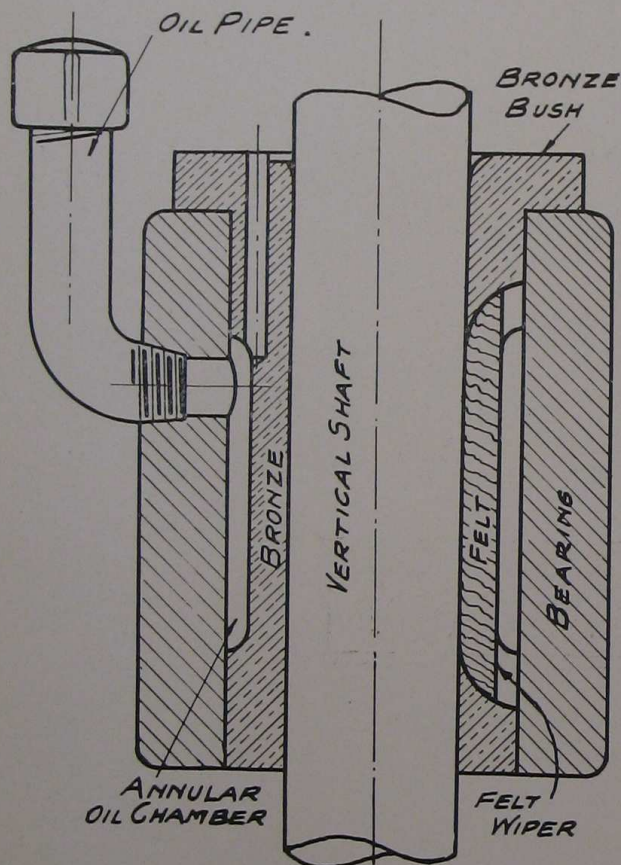


Fig. 1. Oiling Diagram.

insures a continuous and uniform supply of clean oil being fed to the bearings and prevents all waste from oil flooding and running out of the bearing before it has performed its function

The Tapping Attachment is carried on the head, and forms the connection between the arm shaft and back gear mechanism. It is operated through powerful band friction clutches by means of a lever extending under the arm to the front of the machine. This lever is always within convenient reach of the operator, and controls the starting, stopping and reversing of the spindle.

The Reversing Frictions, being located between the point of drive and the back gear mechanism, receive the benefit of the high speeds before any of the reductions through the back gear mechanism take place. This fact, in connection with the unusually large frictional area afforded, insures the maximum amount of power being transmitted through them.

The Head is easily moved along the arm by a hand wheel operating a spiral pinion in rack, a device self-locking at all points, it being necessary to bind the head only for the heavier operations. Back gear mechanism on the head is located between the reversing frictions and the spindle driving gear. It is of an extremely simple, but powerful design, and provides through spur gears and a powerful friction clutch one direct and one reduced speed. These speed changes may be easily and quickly accomplished while the machine is running by means of a lever conveniently placed on the front of the head. With this construction the power necessary for heavy drilling and tapping is developed and concentrated directly on the head mechanism of the drill. Thus the tapping attachment and the driving elements in back of it have but comparatively light duty to perform, thereby insuring long life to the machine under severe duty.

Lubrication. Owing to the high speeds at which the power transmitting members revolve, and also to the fact that the majority of the bearings are of the vertical type, adequate lubrication is one of the most essential features to the successful operation of the machine. The oiling system supplied on "American" Radials is unquestionably of the highest efficiency. The oil is introduced thru a gravity oil pipe, and is led to the annular oil chamber formed in the bronze bushing (see Illustration Fig. 1.) This oil chamber contains a large supply of the lubricant, which is in turn fed to the bearing by means of a strip of felt inserted in a slot cut lengthwise in the bushing. This construction

The Spindle is .65 carbon spindle stock. It is accurately ground to size, and is double splined. The spindle is counter-balanced and is provided with both hand and power feeds, quick advance and return. A speed plate attached to the arm girdle shows at a glance, and without possibility of error, the suitable speeds for any work within the capacity of the machine.

Spindle Speeds are sixteen in number on cone driven radials, and twenty-four in number on speed box driven machines. A very wide and carefully chosen range is provided, which is suitable for a great variety of work, making the machine unusually efficient when drilling with either ordinary carbon or high speed twist drills. This range is from 50 to 600 R. P. M. on the cone drive and 38 to 600 R. P. M. on the gear box drive. Any desired speed is obtainable in a few seconds time while the machine is running by means of two levers, the speed box and the back gear lever, on the gear box driven radials. Only ten gears are used in the speed changing mechanism to obtain the twenty-four speeds. This is by far the simplest speed changing mechanism ever designed. In fact, it would be impossible to obtain this extremely wide range with fewer parts or adjustments. Many radials use from six to twelve more gears and several more levers to obtain the same number of speeds.

The Spindle Thrust is taken on a Ball Thrust Bearing. This feature alone adds considerably to the efficiency of the machine for heavy drilling at high speeds.

Depth Gauge and Automatic Trip is of an improved design. It is very simple in construction and consists primarily of a trip dog and pointer mounted upon a vertical trip rod which acts upon the feed worm clutch through the medium of a lever, one end of which has a suitable handle for engaging and disengaging the power feed by hand. The spindle sleeve is graduated its entire traverse in sixteenths of an inch, which permits of the spindle being accurately tripped at a pre-determined depth from

any position within the limits of its travel by merely setting the trip dog so that its pointer reads from zero to the desired depth. The trip also acts automatically at the extreme limit of spindle travel, thereby preventing breakage of feed mechanism thru carelessness.

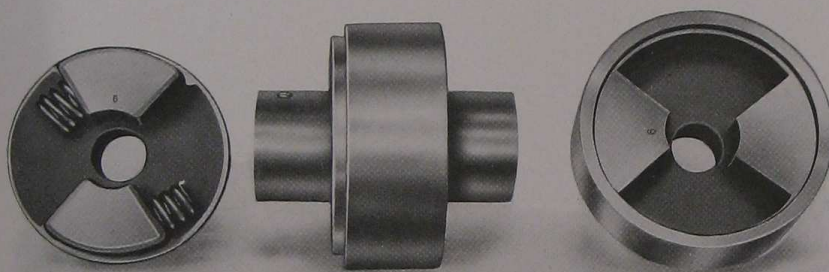


Fig. 2. Spring Shock Absorber.

chosen range, advancing in geometrical progression from .007" to .020" per revolution of spindle. The operation of this mechanism is controlled by means of a dial, on the face of which the respective feeds per revolution of spindle are plainly indicated. Any one of these feeds is instantly obtained by merely turning the dial until the feed desired shows opposite to a fixed pointer.

This method of feed change is by far the most complete yet devised, as it requires no reference to index plates with the subsequent handling of several levers. The rate of feed used is plainly indicated at all times. The feed mechanism is engaged and disengaged at the worm wheel through a friction clutch and lever, which also controls the quick advance and return of the spindle to and from the work. This feed friction is so designed as to permit the drill being crowded to the limit of its capacity without unduly straining the feed works.

6-Speed Box is of Cone and Tumbler construction, affording a positive drive, and eliminating all slipping of frictions under heavy loads. This box gives six (6) changes of speed, each one of which can be instantly obtained while the machine is running at full speed by simply shifting the tumbler from one position to another. The tumbler is locked securely in its position by means of a latch and locking pin, which prevents the throwing out of the same under severe strains. The Cone and Tumbler Gears are of the Brown & Sharpe 20 degree involute pointed tooth type, and are made from a Special Grade of Steel Carbonized and Hardened. Experience has proven this to be the best possible type to use where running gears are meshed broadside, as it makes the meshing of the gears extremely easy and eliminates the tendency of the gears to "ride." An auxiliary drive is provided, which is automatically engaged and disengaged through an improved overtake clutch by the raising and lowering of the sliding Tumbler. This rotates the cone of gears while changing speeds, thus lessening the shock when the Tumbler and Cone Gears

The Feeding Mechanism is located on the head and provides four distinct rates of feed, covering a carefully

are engaged. A spring shock absorber, Fig. No. 2, located in the line of drive between the speed box and the initial driving gears, absorbs all shocks, thereby greatly prolonging the life of the driving mechanism.

Bronze Bearings of the very highest grade are supplied throughout the entire machine, experience having proven phosphor bronze to be the best material available for high speed Bearings.

Steel Gears are supplied wherever our experience has shown them to be essential. The cone and tumbler gears in the speed box are carbonized and hardened. All mating spur gears are cut from the solid with special Brown & Sharpe cutters adapted to the particular number of teeth in each gear, and the center distances are tested for accuracy within very close limits on a special gear testing machine. Bevel gears are cut theoretically correct on bevel gear generators, thus insuring quiet running gears with a minimum of wear.

Countershaft. A double friction countershaft, with speeds 245 and 470 for the cone drive or 285 and 600 for the gear box drive is regularly furnished.

MOTOR DRIVES.

We are prepared to furnish "American" Radials with various methods of electric motor drives.

Motor Drive thru Gear Box. The most popular form of motor drive is that shown by illustration Fig. 3. This consists of either a constant or variable speed motor mounted on an extension to the base, power being transmitted to the gear box by means of three herringbone gears which insure a quiet drive. One of the principal advantages afforded by this type of drive is that, in view of the large number of spindle speeds provided through the speed box and back gear mechanism, either a direct or alternating current constant speed motor can be successfully used. Should a greater number of spindle speeds be required, a variable speed motor may be used, in which case the number of spindle speeds will be 12 times the number of speeds provided by the motor.

Direct Connected Motor Drive. There is also quite a demand for the style of motor drive shown by illustration Fig. 4. This drive consists of a variable speed motor mounted on the base at rear end of the column, and direct connected to the driving shaft by two herringbone gears. With this drive the number of spindle speeds provided is twice the number of motor speeds.

The Motor Drives herein described are known as "Standard Motor Drives." Information regarding "special" motor drive applications will be furnished upon request.

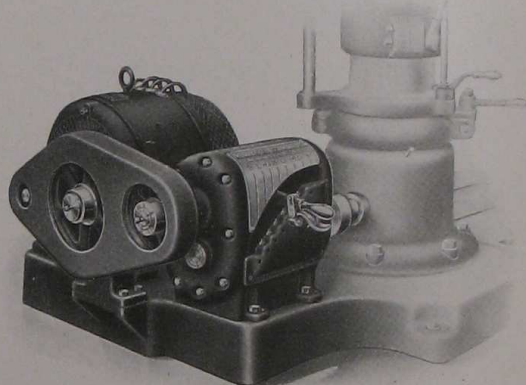


Fig. 3. Constant Speed Motor Drive Thru Six Speed Box.

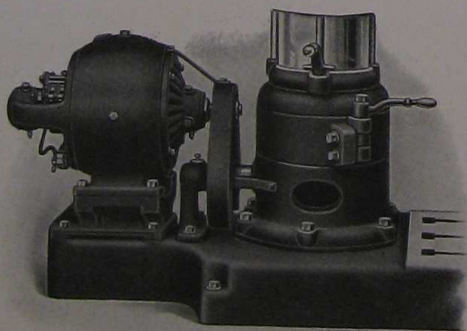


Fig. 4. Variable Speed Direct Connected Motor Drive.

Round Table regularly supplied is of the swinging pattern, has a top surface of 24" diameter. Top surface is supplied with large T-slots. One of the advantages of this type of table is that it can be quickly swung around out of the way, so work can be set up on the base.

The plain box table which can be furnished in lieu of the round table has a working surface of 16" x 22" on top and 12" x 22" on the side.

Regular Equipment, upon which base price is determined, includes either round or plain box table, double friction countershaft and cone pulley drive. Instruction book for installing and operating our machines is regularly supplied. No wrenches are required.

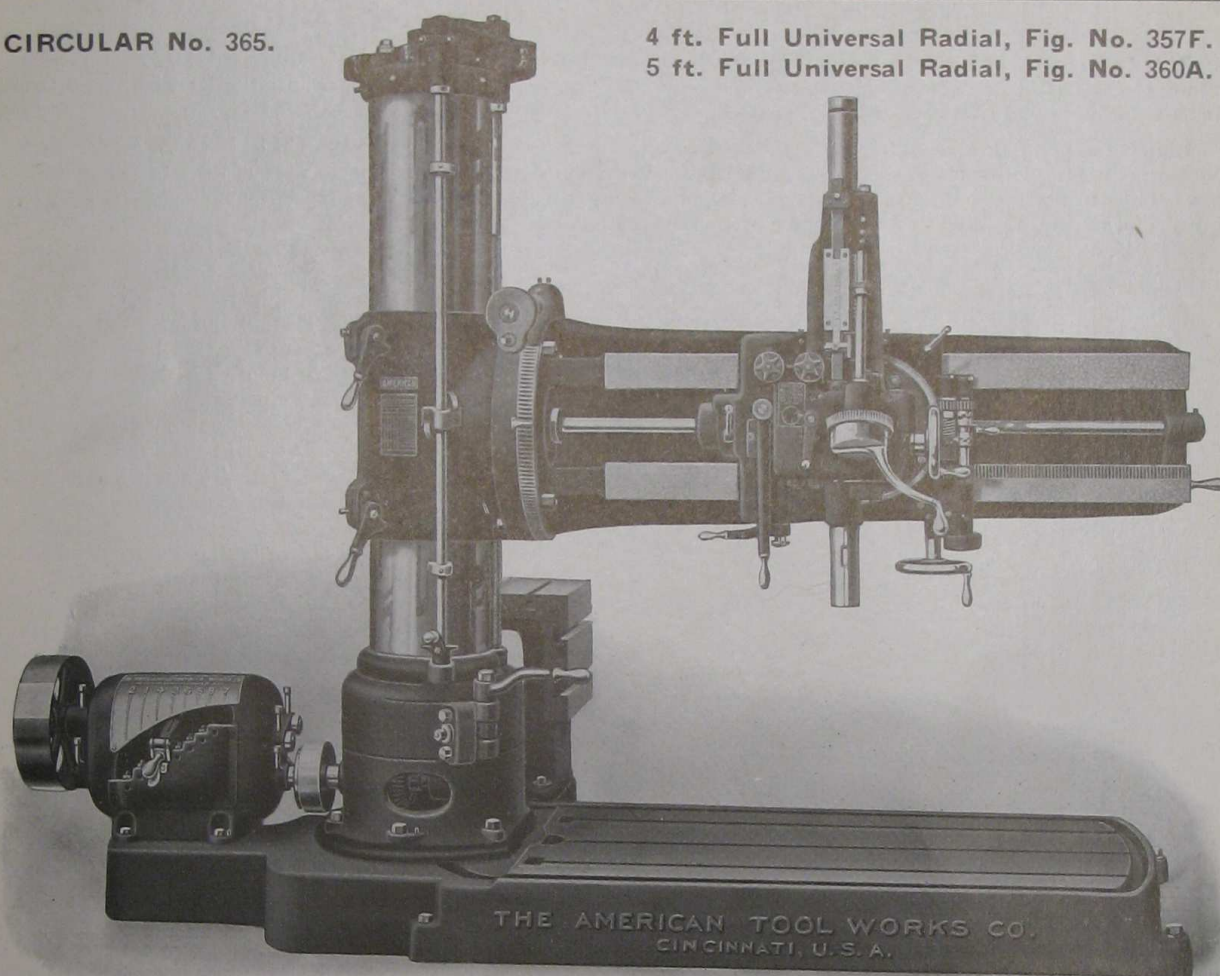
At Extra Cost, we can equip this drill with speed box described above, electric motor drive, Special Bases to suit customer's requirements, and worm swiveling table.

621,95

CIRCULAR No. 365.

4 ft. Full Universal Radial, Fig. No. 357F.

5 ft. Full Universal Radial, Fig. No. 360A.



AMERICAN

4 ft. and 5 ft. Triple Geared, Full Universal Radial Drills.

| | 4 ft. | 5 ft. | | 4 ft. | 5 ft. |
|---|-----------|-----------|---|---------|--------|
| Greatest Distance from Spindle to Base..... | 5' 1/2" | 5' 4" | Drills to Center of Circle outside of Column..... | 8' 1/4" | 10' 6" |
| Range of Spindle Speeds..... | 19-314 | 19-314 | Traverse of Spindle..... | 16" | 18" |
| Range of Feeds..... | .006—.060 | .006—.060 | Traverse of Head on Arm..... | 21 3/4" | 40" |
| Morse Taper in Spindle, No..... | 4 | 5 | Traverse of Arm on Column..... | 38 1/2" | 41" |
| Code Word..... | RAYS | REAP | | | |

The **Universal Radial** has heretofore proven entirely inadequate for the severe duty imposed upon the modern plain arm radial, but its field of usefulness in machine shops is so large that a revolution in design was imperative. Up to the present time the Universal Radial has been incapable of driving to the limit high speed steel drills, principally because of lack of power and springing of the arm. The new machine, shown above, represents a radical departure in design and the very highest development in this type of drill, which we unhesitatingly recommend as being capable of fulfilling the most exacting requirements in Power, Rigidity, Durability and Convenience of Operation.

THE AMERICAN TOOL WORKS CO.

LATHES, PLANERS, SHAPERS, RADIAL DRILLS

MAIN OFFICES AND WORKS

CINCINNATI, U. S. A.

This Radial Drill is the result of long and careful consideration, and in its design we have incorporated the many excellent features of our Plain Radials which have placed them absolutely beyond comparison in their facilities for High Speed Work Production, Accuracy of Alignments and Productive Capacity.

Rigidity of the Arm is doubtless one of the most essential qualities in radial drill design. This, however, is very noticeably lacking in many other makes of Universal Radials, for the reason that either one or more walls of the arm section are cut away in order to incorporate the arm shaft and other transmission elements. This weakening obviously unfits the arm for severe duty and for resisting the combined stresses of torsion and deflection.

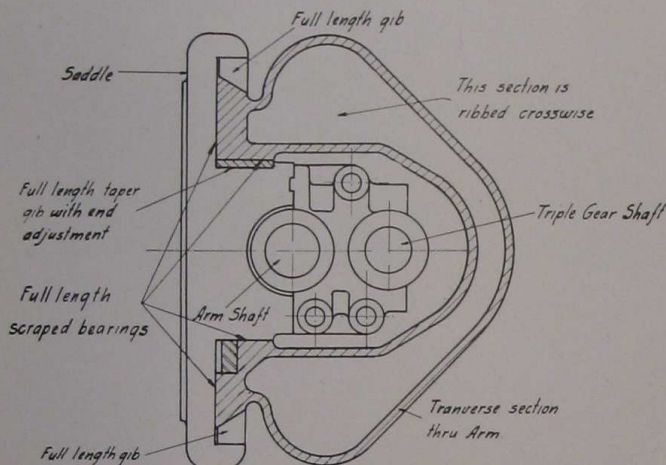


Fig. No. 1. Section thru Universal Arm.

wheel cut in the periphery of the arm flange. This movement, in connection with the swiveling head, permits drilling and tapping at any angle radiating from the center of a sphere, and is firmly clamped as set, by four large binder bolts. Arm is graduated in degrees on its periphery, readings being taken at a fixed pointer.

Head is of very compact design and is equipped with powerful Steel Triple Gears. It may be swiveled through a complete circle by means of a hand wheel and worm which engages a worm wheel fixed to the head. This feature is of special value in setting the spindle for angular drilling. The worm holds the swiveling head in any position, and eliminates all possibility of accident through the head swinging around of its own weight when the clamping bolts are loosened. The hand wheel affords quicker motion than the use of a wrench. Graduations on head show, at a fixed pointer, the angle as set, and three binder bolts are provided for securely clamping the head at any angle. Head is moved rapidly along the arm by means of multiple gearing and rack through the same hand wheel that swivels the head, by simply engaging the clutch shown. A binder is supplied which permits of readily locking the head at any point along the arm.

Saddle Shaft Construction. A feature of great merit is found in the power transmitting elements between the arm shaft and the spindle. The saddle shaft, which forms part of this connection, is offset to one side of the spindle, and is mounted in two (2) long bearings, one of which is integral with the saddle, and the other with the swiveling head. Power is transmitted from the saddle shaft through mitre gears to a shaft in the front of head, from which the spindle is driven through spur gears. This construction eliminates the cramping, consequent loss of power and rapid wear, which is obviously unavoidable in other makes of universal drills where the spindle is driven directly from the arm shaft through bevel gears mounted on each side of an extremely short, single saddle bearing.

Spindle has twenty-four changes of speed, with speed box drive, or cone pulley drive with double friction countershaft, advancing in geometrical progression, ranging from 19 to 314 R. P. M., all immediately available by means of two levers, without stopping the machine. The wide range of speeds obtainable, together with the enormous power and unusual rigidity, render this drill equally efficient when using either the ordinary carbon or high speed twist drills, and particularly fits it for a wide range of tapping requirements. A speed plate fixed to the arm girdle shows at a glance how to obtain suitable speeds for the work being operated upon. Spindle is provided with both hand and power feeds, also with quick advance and return.

Triple Gears are made of steel, are of powerful design, and provide one direct and two reduced speeds through the medium of spur gears and positive clutches. They are operated from the front of the head saddle by a convenient lever, without stopping the machine. Triple gears are mounted on the back of the saddle, and are fully enclosed by the rear walls of the arm, thus permitting the universal arm to be rotated through a complete circle with no possibility of an overhanging mechanism interfering with the work being machined. This is a distinct feature on this drill.

Feeding Mechanism is located on the head, and provides eight (8) distinct rates of positive geared feed, covering a carefully chosen range in geometrical progression from .006" to .060" per revolution of spindle. This mechanism is controlled by

Reinforced Double Section Arm Construction.

The arm design of this new Universal Radial has eliminated every weakness heretofore encountered. It is made in the form of upper and lower tube sections, which are bound together in the back by a double wall of metal, and further re-enforced by heavy transverse ribbing. On the front wall "ways" are formed for carrying the unusually wide and rigid saddle, which is firmly locked at any point along the arm by means of a powerful clamping device. This in addition binds together the double arm sections and saddle into a very compact unit, thus affording unparalleled strength for resisting all strains. Arm is clamped by two binder levers, obviating loose wrenches, and is raised and lowered rapidly by a double thread coarse pitch screw hung on ball bearings, and controlled by a convenient lever, marked ears indicating the proper direction to throw lever for raising or lowering. This lever cannot be operated until slightly raised from its bearing, thus guarding against accident through unintentional movement while the arm is clamped to column. Arm is rotated in a complete circle by worm engaging worm

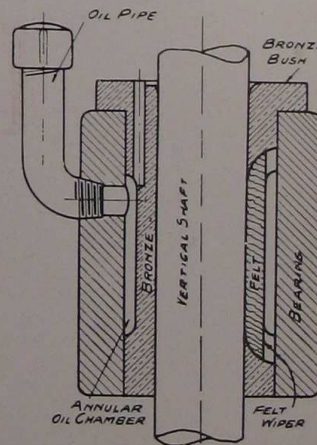


Fig. 2. Oiling Diagram.

two dials, on the face of which the respective feeds are plainly indicated. Any one of the feeds is instantly obtained by merely turning the dial until the desired feed comes opposite a fixed pointer. The rate of feed being used is plainly indicated at all times, and reference to index plates is unnecessary. The feed train is engaged and disengaged at the worm wheel through a Friction Clutch and lever, which lever also controls the quick advance and return of the spindle. This feed friction is so designed as to permit the machine being crowded to the limit of its capacity without unduly straining the feed works.

Depth Gauge and Automatic Trip are of greatly improved and simplified design, and will trip the spindle at any predetermined depth. Readings are taken from zero on a vertical "scale," similar to an ordinary machinist's scale, making unnecessary the reading of a circular gauge. The tripping mechanism is so arranged that the spindle will be tripped at any point within the limit of travel by merely setting the trip dog so that the scale reads the depth to be drilled from zero. This trip acts automatically at the full travel of spindle, thus preventing breakage to feed mechanism. Feed can be tripped by hand at any point.

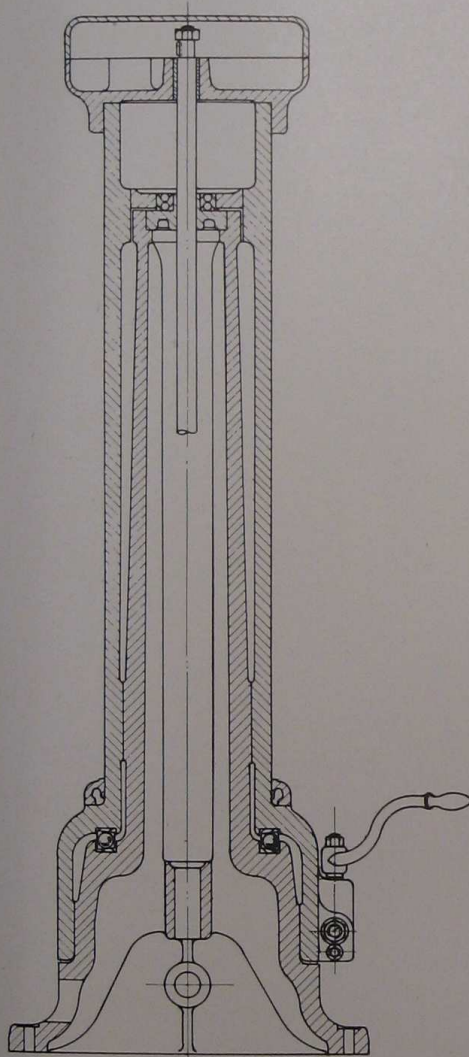


Fig. 3. Cross Section Thru Column.

the bottom. Extensive tests have proven this form of tooth to be far superior to any other for use in a tumbler gear mechanism as it permits of the instantaneous engagement of the gears while running, without danger to the gears, and without "clashing." An auxiliary train of gearing between the pulley and cone shafts is also provided, which is thrown into engagement, through an overtake clutch, by the lifting of the tumbler lever. This rotates the cone gears while changing speeds, and thus permits changes being made without shock to the gears. Tumbler lever and gears are securely located in their various positions by means of a latch and locking pin. A cushion coupling in the line of drive absorbs all shocks, and thus insures long life to the driving mechanism.

Bronze Bearings of the very highest grade are supplied throughout the entire machine, experience having proven phosphor bronze to be the best material available for high speed bearings.

Lubrication. Owing to the high speeds at which the power transmitting members revolve, and also to the fact that the majority of the bearings are of the vertical type, adequate lubrication is one of the most essential features to the successful operation of the machine. The oiling system supplied on "American" Radials is unquestionably of the highest efficiency. The oil

Tapping Mechanism is located in the saddle between the triple gears and the speed box, and is so situated as to afford easy access for any necessary adjustments. The frictions are of unusually large diameter, and run at very high speeds, owing to the high gear ratio, consequently will transmit power far in excess of those used on any other similar size universal radial. Tapping mechanism operates through nickel steel band friction clutches of large diameter. The lever for operating this mechanism is placed on the front of saddle, and controls the starting, stopping and reversing of the spindle. Owing to the fact that the tapping attachment is located between the speed box and triple gears, the frictions, already very powerful, receive the benefit of the triple gear ratio, and have comparatively light duty to perform, thus making possible unusually heavy tapping, without undue strain. Due to the great power of the frictions, they require but a slight adjustment, and the lever operating same is consequently thrown in and out of engagement with a very slight amount of effort.

Column is of the double tubular type providing the equivalent of a double column. The column and column sleeve are both very rigidly constructed, being heavily ribbed on the inside. The column sleeve telescopes the column, and has a bearing at both top and bottom. The sleeve is guided at the top by a high grade ball bearing, while its weight and that of the arm is absorbed by a large ball bearing at the bottom which runs in hardened steel ball races.

Base is of massive proportions, and has unusual depth. Is strongly ribbed lengthwise and transversely, especially at the point where column is bolted. It is planed with the greatest possible accuracy, and has large T-slots with ample allowance of metal around them.

Speed Box is of the cone and tumbler type, and provides eight (8) changes of speed, each one of which is instantly available by the mere shifting of the tumbler lever. All gears in box are made of steel, and are of very coarse pitch and wide face. The cone and tumbler gears are made from a Special Grade of Steel, carbonized and hardened by means of a special process, and are cut with Brown & Sharpe 20 degree involute cutters, which form a very substantial tooth, pointed at the top, and unusually wide at

is introduced thru a gravity oil pipe, and is led to the annular oil chamber formed in the bronze bushings, see illustration Fig. 2. This oil chamber contains a large supply of the lubricant, which is in turn fed to the bearing by means of a strip of felt inserted in a slot cut lengthwise in the bushing. This construction insures a continuous and uniform supply of clean oil being fed to the bearings, and prevents all waste from oil flooding and running out of the bearing before it has performed its function.

Steel Gears are supplied throughout the entire machine. The pinions are regularly cut from the solid bar, while the larger gears are made from steel castings. The cone and tumbler gears in the speed box are carbonized and hardened. All mating spur gears are cut from the solid with special Brown & Sharp cutters adapted to the particular number of teeth in each gear, and the center distances are tested for accuracy within very close limits on a special gear testing machine. Bevel gears are cut theoretically correct on bevel gear generators, thus insuring a quiet running gear with a minimum of wear.

Countershaft. A double friction countershaft, which provides two forward speeds, is regularly furnished with cone driven radials. With speed box driven machines a single friction countershaft is regularly supplied. Speeds of double friction countershaft for the 4 ft. Radials are 277 and 311, and on the 5 ft. 275 and 314. Speed of single friction countershaft is 454 R. P. M. for the 4 ft. and 460 for the 5 ft.

MOTOR DRIVES.

We are prepared to furnish "American" Radials with various methods of electric motor drives.

Motor Drive thru Gear Box. The most popular form of motor drive is that shown by illustration Fig. 4. This consists of either a constant or variable speed motor mounted on an extension to the base, power being transmitted to the gear box by means of three spur gears, a rawhide intermediate gear being used to insure a quiet drive. One of the principal advantages afforded by this type of drive is that, in view of the large number of spindle speeds provided through the speed box and triple gear mechanism, either a direct or alternating current constant speed motor can be successfully used. Should a greater number of spindle speeds be required, a variable speed motor may be used, in which case the number of spindle speeds will be 24 times the number of speeds provided by the motor.

Direct Connected Motor Drive. There is also quite a demand for the style of motor drive shown by illustration Fig. 5. This drive consists of a variable speed motor mounted on the base at rear end of the column, and direct connected to the driving shaft by two spur gears. With this drive the number of spindle speeds provided is three times the number of motor speeds.

The Motor Drives herein described are known as "Standard Motor Drives." Information regarding "special" motor drive applications will be furnished upon request.

Plain Box Table regularly furnished with the 4 ft. Universal Radial has a top surface of 20" x 20" and a side surface of 20" x 14". On the 5 ft. Universal the plain box table has a top surface of 24" x 24" and a side surface of 24" x 16". Both surfaces are accurately planed and are supplied with large "T" slots. Table is mounted on an extension to the base at the side of column, where it will not interfere with the working surface of the base.

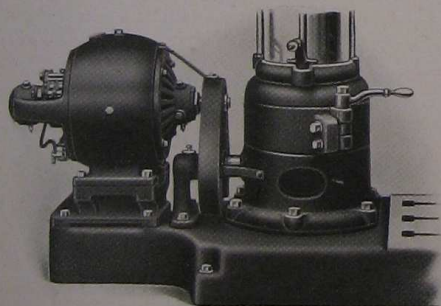


Fig. 5. Variable Speed Direct Connected Motor Drive.

ations on both segment and base show the angle at which the top is set. The table is arranged to be located upon extension to base, but can be used on large base in the same manner as the Plain Box Table.

Regular Equipment upon which base price is determined, includes plain box table, single friction countershaft and gear box drive. Instruction book for installing and operating our machines is regularly supplied. No wrenches are required.

At Extra Cost we can equip this drill with universal table, electric motor drive and Special Bases to suit customer's requirements.

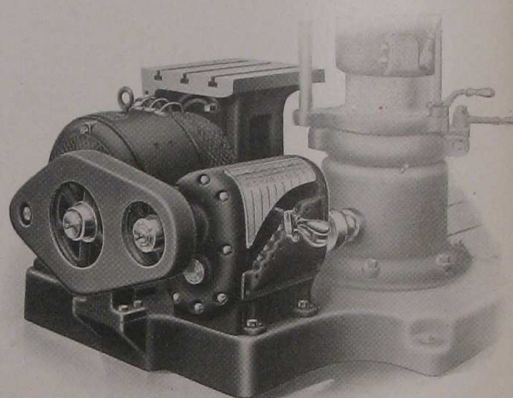


Fig. 4. Constant Speed Motor Drive thru Speed Box.

Universal Table. When desired by customer we are prepared to furnish a Universal table per illustration Fig. 6. It consists of a swivel base on which is mounted a housing which carries the tilting top of table. Top can be swiveled to any angle within 90 degrees, and either face can be set in a vertical position by means of a segment and worm operated through a pair of reduction gears. This arrangement, together with a T-handle wrench, makes it very easy to move table when carrying a heavy load. Top can be securely clamped to housing by two bolts, thereby relieving the worm and segment of undue strain, since they are self-locking in themselves. Graduations on both segment and base show the angle at which the top is set. The table is arranged to be located upon extension to base, but can be used on large base in the same manner as the Plain Box Table.



Fig. 6. Universal Table.