May 5, 1959 A. P. SPECKIN ET AL 2,884,818

DRILL HEAD

Filed May 31, 1955 2 Sheets-Sheet 1

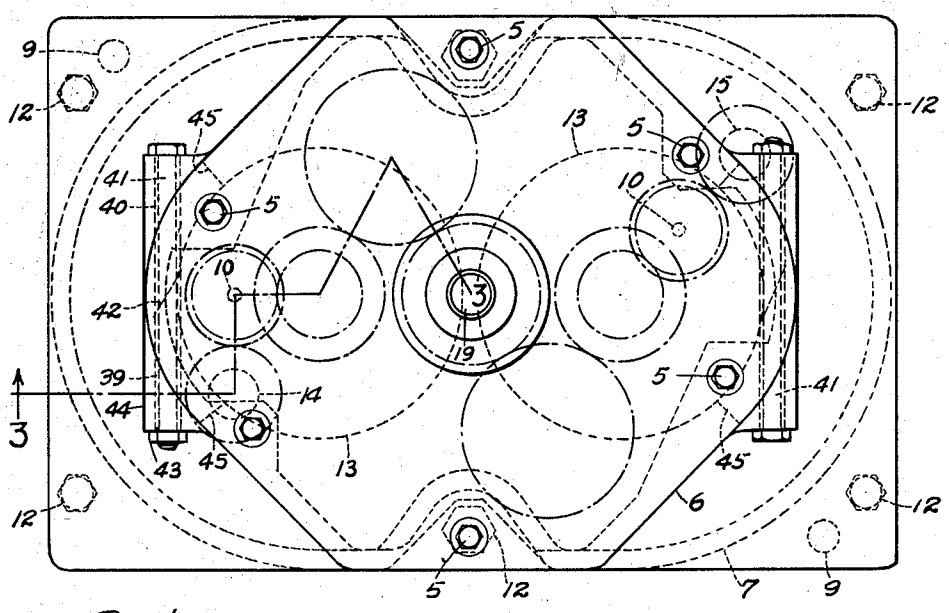


Fig. 1

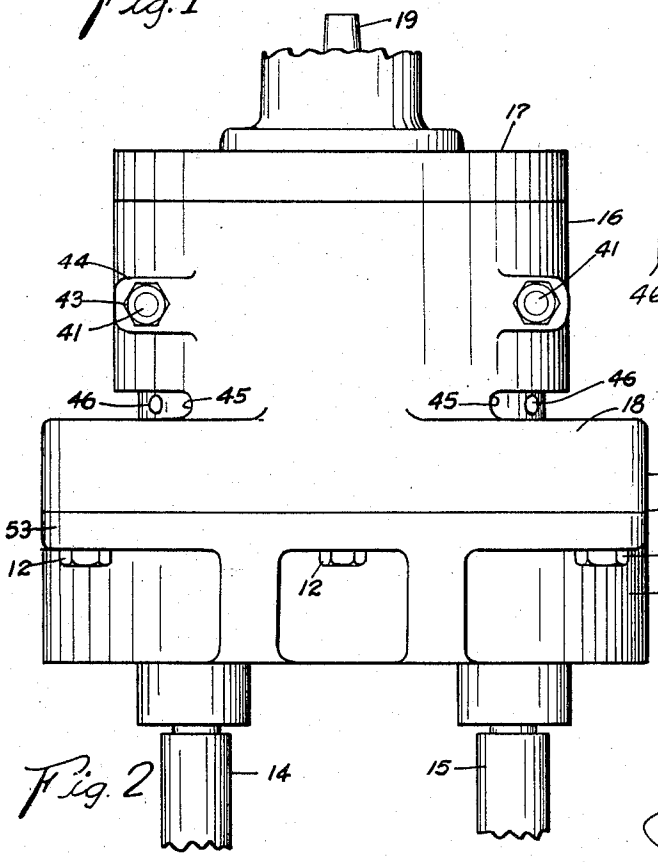


Fig. 2

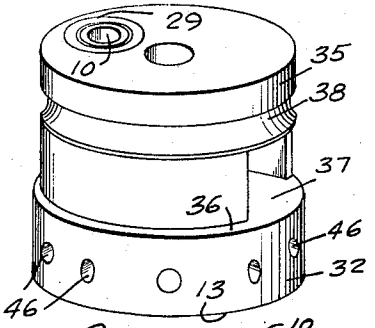


Fig. 5.

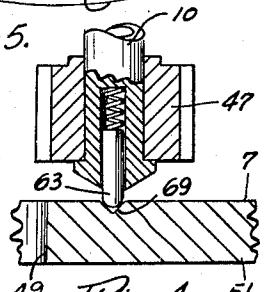


Fig. 4.

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2 Sheets-Sheet 2

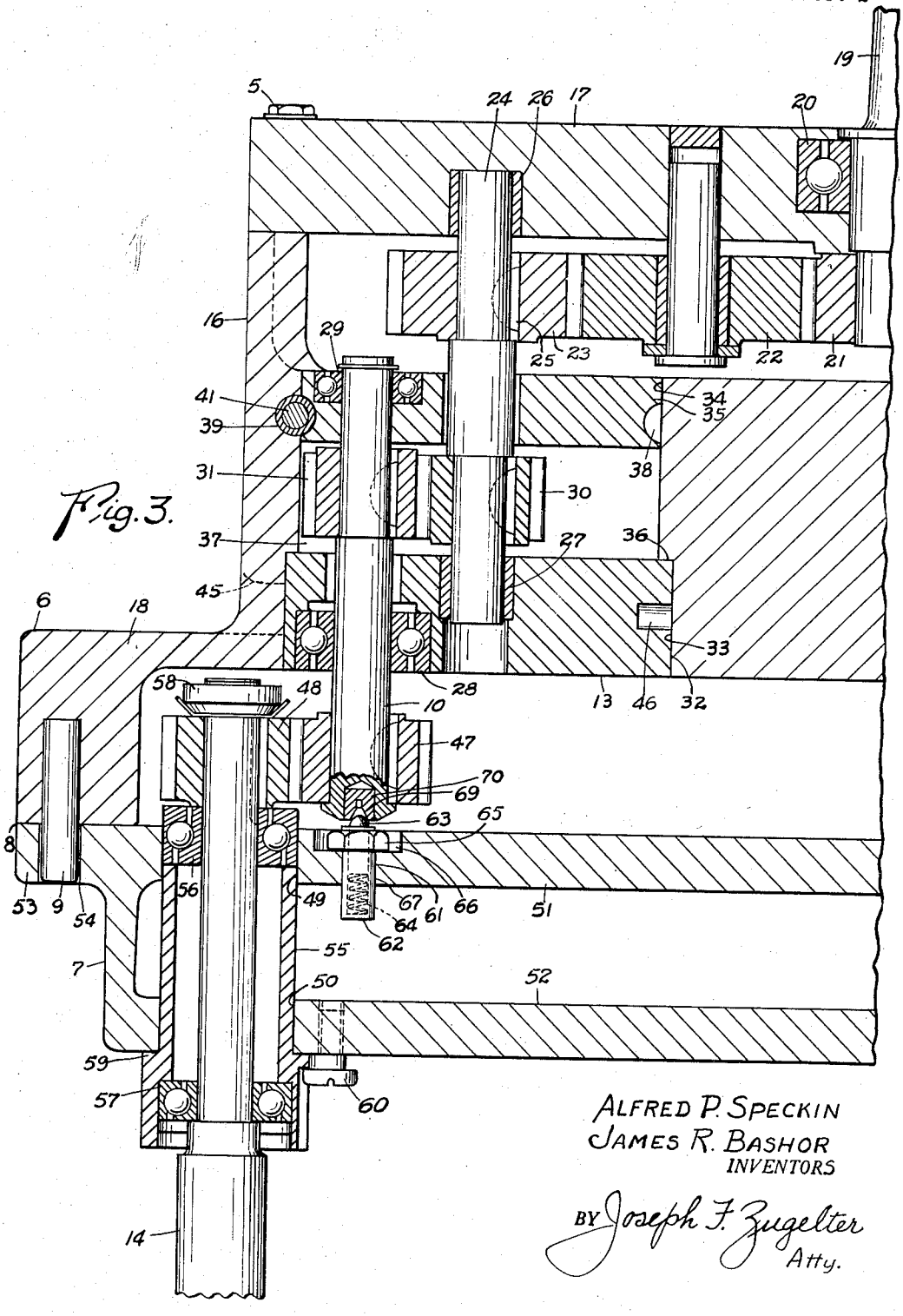


Fig. 3.

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DRILL HEAD

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9 Claims. (Cl. 77—22)

This invention relates to improvements in a drill head, and is adapted particularly to heads of the adjustable multiple spindle type.

An object of the invention is to provide a drill head structure for the performance of special work, but which includes as a major part of its structure a basic standardized unit serving as the foundation for an assembly designed to perform the special work or job specified. As the result of this objective, a manufacturer may keep on hand a supply of the basic units in readiness for application of special structure thereto for the performance of any particularly specified job, with the advantage that an order received for a special drilling pattern may be well on the way to fulfillment, upon receipt of the order and specifications.

Another object of the invention is to obtain the advantages, resulting directly from the advantage above stated, of reducing the expense of manufacture by eliminating hasty engineering and production procedure, expensive overtime work, and errors due to hasty procedures in engineering and production.

A further object of the invention is to structurally improve a multiple spindle head for drilling, tapping, reaming and the like, in the interests of simplicity, accuracy, durability and lowered cost of manufacture.

Another object is to make it possible for a customer owning a basic standardized unit of a head, to obtain from the head manufacturer the specialized minor assembly needed in performing any special drilling, tapping, or reaming job, without returning the basic unit to the head manufacturer, thereby effecting a saving of time and expense in handling and shipping.

Another object is to simplify and expedite relocation of spindles in a drill head, without loss of accurate and rigid support for the spindles.

The foregoing and other objects are attained by the means described herein and illustrated upon the accompanying drawings, in which:

Fig. 1 is a top plan view of the improved drill head of the invention.

Fig. 2 is a side elevational view of the same.

Fig. 3 is an enlarged vertical cross-sectional view taken on line 3—3 of Fig. 1, altered to the extent of showing the gears in a mommon vertical plane in the interests of clarity and simplicity of disclosure.

Fig. 4 is a fragmental cross-sectional view of a modification.

Fig. 5 is a perspective view of an eccentric or drum forming a detail of the invention.

The drill head of the present invention consists of two assemblies, indicated generally by the characters 6 and 7, the assembly 6 being the upper assembly herein referred to as the basic standardized unit. The lower assembly 7 is the special minor assembly which may be formed or built in accordance with customer specifications, to locate the spindles in various patterns or arrangements for the performance of any desired or required operation of drilling, tapping, reaming, or the like.

The two assemblies are separable along the joint 8 at the locating pins 9.

The upper or basic unit 6 is in itself a complete adjustable multiple spindle head which may be used as such by the substitution of a drill spindle for the adjustable idler shaft 10. That is, by removing the screws 12, dropping the lower assembly 7, and replacing the idler shaft 10 with a spindle, the upper assembly may be used as a drill head the spindle of which may be adjusted laterally by rotating the eccentric or drum 13 and locking it in the adjusted position. A proper direction of rotation for the replacement spindle may be had by reversing the power source, or by adding or subtracting an idler gear. In the example shown, the upper or basic unit includes two independent eccentrics or drums 13, but in practice the unit may include a greater number of such eccentrics or drums, depending upon the number of spindles required for performance of the particular drilling job specified. The shape and size of the head will of course be determined by the number of spindles incorporated therein. The spindles illustrated upon the accompanying drawings, are identified by the characters 14 and 15.

The following is a description of the upper or basic standardized unit 6. This unit comprises a main casing or gear housing 16 having a top wall 17 secured in place by screws 5, and a circumferential lower flange 18. The flange may carry the locating pins 9 which position the lower or minor unit relative to the flange. At the approximate center of the main casing is an upstanding main shaft 19 which is adapted for connection to a source of power, such as a motor driven spindle or shaft of a drilling machine. The shaft 19 may be supported for rotation in a suitable bearing 20, and carries a driving gear 21 fixed thereon. Gear 21 is in mesh with an idler gear 22 which drives another idler gear 23, the latter being suitably fixed to the upper portion of the drum shaft 24, as by means of a key 25. The shaft 24 may be journalled in suitable bearings 26 and 27 supported by the main casing and the drum or eccentric 13. The axis of shaft 24 coincides with the axis of rotation of the drum or eccentric.

The adjustable idler shaft 10 is rotatably supported by the drum 13 in bearings 28 and 29, located upon the drum in position to dispose shaft 10 in offset relationship to shaft 24, the shafts being parallel to one another. By means of gears 30 and 31, fixed to the drum shaft 24 and to the idler shaft 10, respectively, a drive is effected from shaft 24 to shaft 10. These gears are constantly in mesh with one another, so that the adjustable idler shaft 10 will be driven by shaft 24 notwithstanding rotational adjustments of drum 13 about its shaft 24, for disposing the shaft 10 at various distances from the center-line of the drill head, the center-line being coaxial with the drive shaft 19.

The drum or eccentric 13 is in the form of a cylinder, and may be slightly enlarged at its lower end to provide a flange 32 snugly but rotationally fitted to an enlarged annular bore 33 in the casing 16. The reduced diameter portion 34 of the bore similarly supports the upper bearing portion 35 of the drum, whereas end thrust in the upward direction is resisted by the shoulder or abutment 36 where the drum flange rests upon the casing. The drum may be cut away transversely to provide a chamber 37 which accommodates the gears 30 and 31.

In the upper portion preferably, the drum may be annularly grooved as at 38, to receive an element of a clamp or lock the purpose of which is to fix the drum selectively in any rotated position. In the example shown, a cylinder clamp is suggested for the purpose, although as will be understood, clamps or locks of various other types might be employed. The cylinder clamp comprises the

usual cooperative sleeves 39 and 40 axially arranged upon a bolt 41, with the sleeves complementarily tapered on an angle as at 42, so that by advancing the nut 43 along the bolt, one of the sleeves will be thrown off center relatively, to bear firmly against the wall of the groove 38 and thereby clamp the drum against rotation. The cylinder clamp elements may be housed within a bored boss 44 which is formed integrally with the housing or casing 16.

Upon loosening the clamp nut 43, the drum 13 may be rotated to adjusted positions. Access to the drum for the purpose of rotating same, may be had through an elongate slot 45 formed horizontally in the casing 16, and through which may be inserted a suitable implement to engage one of several holes 46 formed in the periphery of the drum. By inserting an implement such as a rod, in any one of the holes 46, the leverage necessary for rotating the drum is obtained. As was previously pointed out, such rotation of the drum about its vertical axis serves to swing the drum shaft 10 and its gear 47 in a circular path, whereby said gear may be placed in proper position to mesh with the spindle gear 48.

The drilling or tapping spindle 14, with its gear 48, is mounted upon the lower or minor assembly 7, which includes a vertical bore 49—50 adapted to receive the spindle unit. To provide the maximum lateral support for the spindle unit, and to reduce the weight of the lower assembly, the latter may be made hollow as shown, with two parallel walls 51 and 52. In effect, however, the two walls may be considered as one, and may be referred to as the plate of the lower assembly or unit. The plate has an extending flange 53 drilled as at 54 to receive the several locating pins 9.

The spindle unit may comprise a quill or cylindrical body member 55 fitted with internal bearings 56 and 57 which rotationally support the spindle shaft, and at the upper end of said shaft is fixed the gear 48. A retaining nut 58 locks the gear in position, and may be removed for the purpose of fitting gears of different diameters to the upper end of the spindle shaft. The quill may have a shoulder 59 to abut the lower face of the plate, and a suitable fastener 60 may be employed to hold the quill in position upon the plate, with gear 48 in proper mesh with gear 47. The lower end of the spindle 14, as usual, carries suitable means, not shown, for holding a drill, tap, or other tool.

At 61 is indicated a gear locator, or locating detent the purpose of which is to provide a snap latch or stop for arresting rotative movement of the drum 13, as the drum is indexed to bring gear 47 into mesh with the spindle gear 48. The locating detent or latch may comprise a tubular case 62 containing a plunger 63 projected upwardly by a spring or other resilient means 64. Near its upper end, the case 62 may carry a fixed head 65 adapted to rest within a recess 66 of the plate part 51, leaving the plunger tip exposed above the plane of the plate part. A bore 67 in the plate supports the case of the locating device, which may be secured within the bore by means of a drive fit, or by screw threads if desired.

The plunger of the detent is adapted to enter a socket 69 provided on the lower end of the adjustable idler shaft 10, axially thereof. The socket may be formed directly in the material of the shaft, or as indicated, it may be formed in an insert 70 of bearing metal so as to minimize friction and wear. The detent plunger is to be located upon the plate 51 with such accuracy, as to ensure proper intermeshing of the gears 47 and 48 when the drum 13 is rotated for placing the idler gear 47 in mesh with the spindle gear 48. With the detent solidly centered in the socket 69, the drum may be tightly clamped in the adjusted position, for maintaining the gears in proper mesh.

The proper position of the detent upon the plate 51, with relation to the spindle axis, is determined by the sizes of gears 47 and 48. More specifically, the detent is to be mounted on the plate at a distance from the axis of the spindle, equal to the sum of the pitch diameters of gears 47 and 48. Moreover, the detent is to be on the orbit of travel of the idler shaft axis, so that at any one position of the idler shaft 10 the detent will engage the socket 69.

It will be understood, of course, that in the absence of a locating device such as 63—69, the gears 47 and 48 may be meshed by the trial method, consisting of rotating the drum in one direction and the other until the gears are believed to be in proper mesh. However, the detent or gear locator is preferred, as it eliminates all possibility of error in meshing the gears on their true pitch circles.

Attention is directed to Fig. 4, the only purpose of which is to show that the parts 63 and 69 of the gear locator or snap latch may be reversed, if desired, the plate 51 carrying the socket 69 and the idler shaft 10 carrying the spring-projected detent 63.

Referring now to Fig. 2, let it be assumed that the spindles 14 and 15 have been applied to the lower assembly 7 at certain distances from the center-line of the head, for the performance of a specific drilling job on a work-piece. Assume further, that the job for which the spindle arrangement was originally set up, has been completed, and that the particular spindle arrangement illustrated is no longer needed. The machinist will thereupon remove the screws 12 and displace the lower unit or assembly 7 from the upper basic unit 6, leaving the drum shaft and gear 47 in place upon the unit 6. The drilling spindles 14 and 15, of course, will remain on the lower unit, but may be detached therefrom by removing the screws 60.

Now, if a new and different drilling job is to be performed, the machinist will supply the details thereof to the drill head manufacturer, who will produce a new lower assembly 7 adapted for performance of the new drilling job. The new lower assembly will fit the existing head casing 6, but its spindle-receptive holes 49—50 and any others to be provided, will be formed in the plate 51—52 to suit the locations of holes to be drilled or tapped in performing the new job. The drill head manufacturer will locate not only the spindle holes, but will also drill the holes for the locating detents. The locations for the detents are determined by calculations which take into account the pitch diameters of the spindle gear and the adjustable idler gear, and the position of the spindle with respect to the drum axis. If desired, the head manufacturer may furnish the new lower assembly complete with spindles and detents installed, whereupon the customer or machinist upon receipt of the assembly need only release the drum clamp, rotate the drum to dispose the gear 47 out of the way of the spindle gear, and then bolt the lower assembly to the upper unit in the position determined by the locating pins. The final step in perfecting the assembly will be that of rotating the drum, by means of a rod or similar implement applied to the spanner holes 46, until the socket 69 of the idler shaft 10 registers with the spring plunger or detent 63. When these parts register, they will engage with a snap action which can be felt by the mechanic, who will then know that the gears 47 and 48 are in proper mesh. After tightening the drum clamp 41 and providing the necessary lubrication, the head is ready for use in the drilling or tapping of the new work-piece.

As was previously pointed out herein, the basic upper assembly 6 may be used independently of the lower assembly 7 as an adjustable spindle head of limited application, by the substitution of drilling or tapping spindles for the adjustable idler shafts 10, which are easily removable. Of course, this may require operation of the power source in reverse direction to obtain a proper direction of rotation of the spindle, or as an alternative, an even

number of idler gears may be provided in the train constituting the transmission.

In conclusion, it should be understood that the device as constructed in accordance with the present invention, will effect great savings of time, labor, and materials in the manufacturing field. It will greatly expedite the filling of orders for drill heads needed in the manufacture of drilled work-pieces, and will thereby contribute materially to progress in the production of manufactured goods. The means whereby these and other advantages are attained, are simple and inexpensive, and no sacrifice of durability or serviceability is suffered in practicing the invention.

It will be understood, of course, that proper and adequate bearings, gearing, and materials are contemplated in actual production of the device, and that various modifications and changes in structural details may be resorted to in accordance with good engineering practice, within the scope of the appended claims.

What we claim is:

1. A multiple spindle head comprising in combination, a basic upper unit including a gear casing, a rotatable drive shaft journalled in the casing and having a driving gear fixed thereon, a drum in the casing supported for rotation in offset relationship to the drive shaft, an adjustable idler shaft rotatably supported by the drum in offset relationship to the axis of rotation of the drum, an idler gear fixed on said idler shaft, means on the casing transmitting rotation of the drive shaft gear, to the idler shaft in all rotated positions of the drum, a lower replaceable unit in the form of a plate detachably secured to the basic upper unit, a tool-supporting spindle rotatably mounted upon and displaceable with said replaceable unit independently of the idler shaft of the basic upper unit, a spindle gear fixed upon said spindle in position to be engaged and disengaged with respect to the idler shaft gear upon rotation of the drum relative to the casing, and means accessible exteriorly of the gear casing of the basic upper unit, for rotating the drum and thereby adjusting the idler shaft gear toward and from the spindle gear.

2. A multiple spindle head comprising in combination, a basic upper unit including a gear casing, a rotatable drive shaft journalled in the casing and having a driving gear fixed thereon, a drum in the casing supported for rotation in offset relationship to the drive shaft, an adjustable idler shaft rotatably supported by the drum in offset relationship to the axis of rotation of the drum, an idler gear fixed on said idler shaft, means on the casing transmitting rotation of the drive shaft gear to the idler shaft in all rotated positions of the drum, a lower replaceable unit in the form of a plate detachably secured to the basic upper unit, a tool-supporting spindle rotatably mounted upon and displaceable with said replaceable unit independently of the idler shaft of the basic upper unit, a spindle gear fixed upon said spindle in position to be engaged and disengaged with respect to the idler shaft gear upon rotation of the drum relative to the casing, means accessible exteriorly of the gear casing of the basic upper unit, for rotating the drum and thereby adjusting the idler shaft gear toward and from the spindle gear, and cooperative stop means on the idler shaft and the replaceable unit, to ensure proper meshing of the idler gear with the spindle gear.

3. A multiple spindle head comprising in combination, a basic upper unit including a gear casing, a rotatable drive shaft journalled in the casing and having a driving gear fixed thereon, a drum in the casing supported for rotation in offset relationship to the drive shaft, an adjustable idler shaft rotatably supported by the drum in offset relationship to the axis of rotation of the drum, an idler gear fixed on said idler shaft, means on the casing transmitting rotation of the drive shaft gear to the idler shaft in all rotated positions of the drum, a lower replaceable unit in the form of a plate detachably secured to

the basic upper unit, a tool-supporting spindle rotatably mounted upon said replaceable unit in substantial parallelism with the idler shaft of the basic upper unit, a spindle gear fixed upon said spindle to mesh with the idler shaft gear, means accessible exteriorly of the gear casing of the basic upper unit, for rotating the drum and swinging the idler shaft gear toward and from the spindle gear, and a snap latch disposed intermediate the idler shaft and the plate, to arrest swinging movement of the idler shaft upon predetermined rotational movement of the drum.

4. A multiple spindle head comprising in combination, a basic upper unit including a gear casing, a rotatable drive shaft journalled in the casing and having a driving gear fixed thereon, a drum in the casing supported for rotation in offset relationship to the drive shaft, an adjustable idler shaft rotatably supported by the drum in offset relationship to the axis of rotation of the drum, an idler gear fixed on said idler shaft, means on the casing transmitting rotation of the drive shaft gear to the idler shaft in all rotated positions of the drum, a lower replaceable unit in the form of a plate detachably secured to the basic upper unit, a tool-supporting spindle rotatably mounted upon said replaceable unit in substantial parallelism with the idler shaft of the basic upper unit, a spindle gear fixed upon said spindle to mesh with the idler shaft gear, means accessible exteriorly of the gear casing of the basic upper unit, for rotating the drum and swinging the idler shaft gear toward and from the spindle gear, a detent on the plate resiliently urged constantly toward the drum, and located in position to be struck by the idler shaft as the drum is rotated, the idler shaft having a socket on its axis to receive the detent and locate the idler shaft, with the gears of the idler shaft and the spindle in mesh, and means for fixing the location of said gears as determined by the detent.

5. A multiple spindle head comprising in combination, a basic upper unit including a gear casing, a rotatable drive shaft journalled in the casing and having a driving gear fixed thereon, a drum in the casing supported for rotation in offset relationship to the drive shaft, an adjustable idler shaft rotatably supported by the drum in offset relationship to the axis of rotation of the drum, an idler gear fixed on said idler shaft, means on the casing transmitting rotation of the drive shaft gear to the idler shaft in all rotated positions of the drum, a lower replaceable unit in the form of a plate detachably secured to the basic upper unit, a tool-supporting spindle rotatably mounted upon said replaceable unit in substantial parallelism with the idler shaft of the basic upper unit, a spindle gear fixed upon said spindle to mesh with the idler shaft gear, means accessible exteriorly of the gear casing of the basic upper unit, for rotating the drum to adjust the idler shaft gear into mesh with the spindle gear, and means for fixing the location of the gears so meshed.

6. A device as specified by claim 5, wherein the last mentioned means comprises a detent on the plate resiliently urged constantly toward the drum, and located in position to be struck and depressed by the idler shaft as the drum is rotated, the idler shaft having a socket on its axis to receive the detent and locate the idler shaft, with the gears of the idler shaft and the spindle in mesh.

7. As a new article of manufacture, a spindle locating plate unit for detachable fixation to a drill head having a rotatable bodily swingable idler gear shaft, said unit comprising a plate portion bored to receive at least one tool-carrying spindle including a gear rotatable relative to the plate, and an idler gear shaft locator on the plate, spaced from the axis of the spindle bore a distance equal to the sum of the pitch diameters of the spindle gear and the idler shaft gear, said idler gear shaft locator being in the form of a snap latch on the plate to engage an end of the idler gear shaft.

8. As a new article of manufacture, a spindle locating plate unit for detachable fixation to a drill head casing including a rotatable idler shaft having an end socket, and a gear on the shaft, both bodily swingable laterally to

various adjusted positions, said unit comprising a plate portion bored to receive at least one tool-carrying spindle including a gear rotatable relative to the plate, and an idler shaft locator on the plate, comprising a detent resiliently urged in a direction toward and parallel to the idler shaft, for engaging the end socket of the idler shaft, said detent being mounted on the plate and spaced from the axis of the spindle bore a distance equal to the sum of the pitch diameters of the spindle gear and the idler shaft gear.

9. As a new article of manufacture, a spindle locating plate unit for detachable fixation to a drill head casing including a rotatable idler shaft having a central detent resiliently urged outwardly from one end thereof, and a gear on the shaft, both bodily swingable laterally to various adjusted positions, said unit comprising a plate portion bored to receive at least one tool-carrying spindle including a spindle gear, said plate portion having a socket for receiving the detent as the idler shaft is swung to a predetermined position, the socket being spaced from the axis of the spindle bore a distance equal to the sum of the pitch diameters of the spindle gear and the idler shaft gear.

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