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PORTABLE ELECTRIC ROUTER

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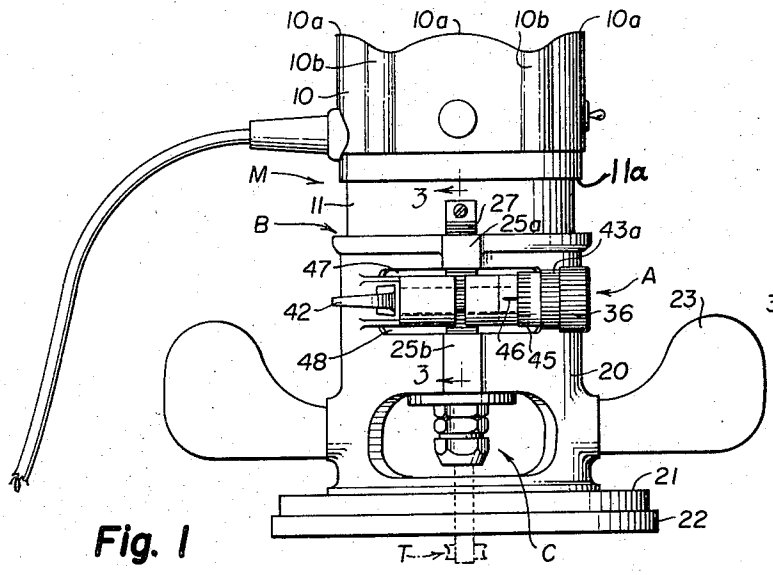


Fig. 1

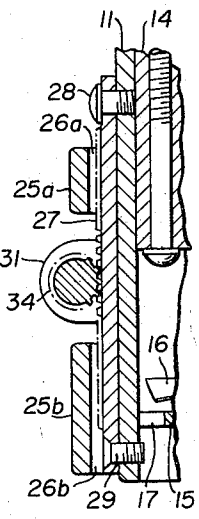
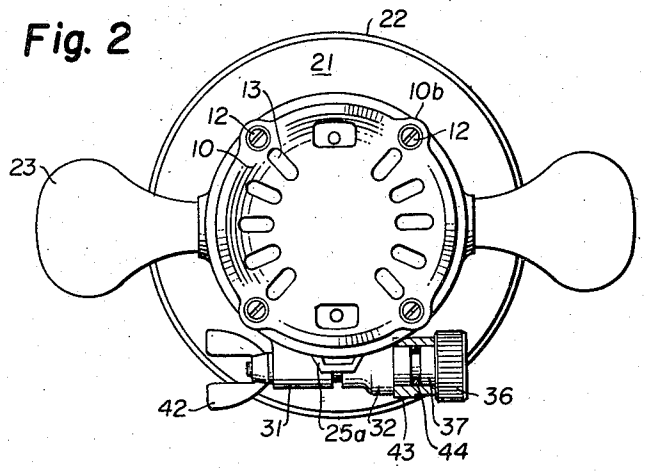


Fig. 3

Fig. 2



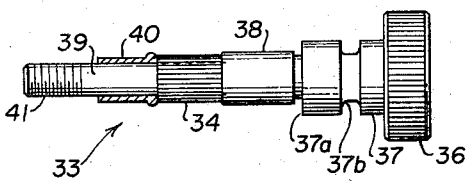


Fig. 4

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PORTABLE ELECTRIC ROUTER

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6 Claims. (Cl. 144—134)

The present invention is concerned generally with structural improvements in portable electric tools relating to adjustability of one part with respect to the other; more particularly to a rack and pinion type adjusting mechanism and its relation to the overall structure in a portable electric hand router. However certain features of the invention may find application in other environments.

The present invention is hereinafter described as embodied in a portable electric hand router to which it is particularly adapted and in which environment it has decided advantages over prior structures. Generally speaking, portable hand routers of the type here considered have a supporting base structure slidably engageable with the work including a generally cylindrical upright sleeve receiving the lower end of an electric motor casing, the electric motor being vertically or axially adjustable with respect to the sleeve to vary the position relative to the base of a tool bit chucked at the lower end of the motor shaft coaxially aligned with the sleeve.

Various cooperating structures have been provided by the prior art between the motor casing and the base for attaining the required adjustment. Thus in some cases a cylindrical split sleeve type base with clamping bolt means engaged in integral lugs on opposite sides of the split has been the simple expedient used to permit axial sliding adjustment and clamping of a motor unit with a corresponding outer cylindrical casing surface received in the sleeve. Other routers have added to such structure a longitudinal rack on the motor casing engaged by pinion rotatably journalled on the sleeve formation of the base. At times such rack and pinion mechanisms have included on or in association with the pinion shaft a graduated sleeve which may be set relative to a fixed index mark either to "zero" or a selected reading, whereby the linear or axial shift effected or desired may be directly observed. Such structures for indication of the axial adjustment however have had certain untoward features of relative complexity of structure in view of the end to be attained, certain awkwardness in manipulation, or stepwise rather than continuous variability of the setting of the graduated scale. Also prior router structures under some circumstances have been awkward in the overall manipulation for effecting the required adjustment.

By the present invention there is provided in a router conventional in its overall structure a rack and pinion adjustment of novel character which serves also as a means for clamping or holding the adjusted elements of motor and base in selected position and further provides in the router a motor casing structure having what may be termed a "squared end" whereby the router may be inverted upon the "squared end" as a stable supporting base for more convenient and precise setting of the tool position. The latter feature is obtained by forming the top of the motor casing, that is the end opposite the tool bearing shaft end, with at least three well spaced extreme end points defining a plane perpendicular to the axis of the router to provide a stable base. By such

means when the router is inverted and position adjustment made the relatively lighter base portion of the router is shifted rather than the much heavier motor unit, thereby conducing to more precise and convenient setting. Further the strain on the rack and pinion mechanism is accordingly smaller, with less wear on the same to prolong its useful life.

However, it is to be noted that although such feature of the motor casing is particularly advantageous with rack and pinion adjusting structures, it also may be advantageously incorporated in other types of routers, such as those including a male threaded motor casing axially adjustable by its threaded engagement with a female threaded base sleeve, or those including the simple telescoped cylindrical motor casing and split clamping sleeve structure; since even with the latter structures the great convenience resulting from invertability of the router as a whole upon motor end as a stable base is clearly meritorious per se and as permitting more precise measurement of the bit position relative to the base in setting operations.

An object of the present invention is then to provide a portable tool including as a relatively large part thereof a motor assembly which may be inverted or stood upright in stable position upon one end of the motor casing for convenience in adjustment of a tool carried at the opposite end of the motor unit. Another object is the provision, in a portable hand tool such as an electric router having a motor unit axially shiftable with respect to a base assembly or other portion of the portable tool, of a base formation at one end of the motor casing which permits convenient adjustment of the base assembly of the tool.

A still further object is the provision of a rack and pinion type adjustment in a tool of the character described wherein clamping of the mechanism in selected position is achieved in the rack and pinion assembly itself. A still further object is the provision of a rack and pinion type adjusting assembly which includes a position shift indicating graduated sleeve coupled by simple means to the pinion operating shaft in such manner that an infinitely continuous setting of the sleeve may be obtained.

Other objects and advantages will appear from the following description and the drawing, wherein:

Fig. 1 is a front elevational view of a portable electric router embodying the present invention;

Fig. 2 is a top plan view of the router of Fig. 1 with the electric cord and switch omitted for clarity;

Fig. 3 is a fragmentary sectional view taken longitudinally through the rack and pinion tool adjustment mechanism of the router; and

Fig. 4 is a detail view of the pinion shaft of the adjustment mechanism.

For convenience in description and structural recitation of the claims, relative positions of elements will be set forth in terms of a router disposed as in the drawing. As indicated by general reference characters in Fig. 1, the router includes a high speed commutating electric motor M, telescoped in a base assembly B to permit adjustment of the motor—and hence of a router bit or other rotationally driven tool T carried in the chuck C mounted on the bottom end of the motor shaft—in an axial sense relative to the base assembly, by an adjusting and clamping mechanism A of the rack-and-pinion type.

The motor M includes the upper and lower housing members 10, 11 fitted together endwise and secured by the four equispaced screws 12 extending through the upper member into threaded engagement with the lower. To the member 10, serving as a motor end bracket carrying the usual insulated brush holders, upper armature bearing and motor switch, and provided with a plurality of

ventilating air inlet apertures **13**, the field core structure **14** is bolted endwise for telescoped disposition within the cylindrical shell comprising the lower housing member **11**. The lower end of the latter is spanned by a lower shaft bearing supporting integral spider **15**, spaced from the field core to provide space for a motor ventilation fan **16** on the armature shaft exhausting through spider openings **17** to direct air as a chip cleaning blast downwardly upon the working area.

In the base assembly B, the generally cylindrical sleeve **20** has an integral bottom flange **21**, to which is secured a suitably apertured sub-base disk **22** of plastic, compressed fiber plastic or other material suitable for sliding contact with the work, and further has a pair of diametrically disposed handles **23**, as usual in such tools. The interior cylindric surface of the base sleeve **20** and the exterior of lower motor housing **11** are sized for a sliding fit to the region where the top of sleeve **20** encounters shoulder **11***a* on the upper end of the housing **11**. Diametrically opposed openings in the sleeve allow access with wrenches to the chuck for the relative position shown, as well as escape of working debris removed by the ventilating exhaust air blast.

The structure as thus far described is generally similar in a broad sense to known routers. However particular features are now described, relating to the adjustment and maintenance of a selected bit position relative to the base by axial shifting of the motor assembly.

Midway between the handles, one side of the sleeve **20** has an interrupted vertical external rib formation **25***a*, **25***b* permitting the underlying internal surface of the sleeve to be internally slotted at **26***a*, **26***b* for accommodation of a vertical rack element **27** secured to the lower motor housing **11** by screws **28**, **29**. The side walls of the slot by embracing the sides of the rack may provide a guide preventing turning of the base with respect to the motor and thereby aiding retention of the rack and pinion elements in proper operative relation.

Integrally formed on the sleeve on opposite sides of the centerline of the aforementioned rib are a pair of generally similar outwardly projecting lugs **31**, **32** with aligned bores to receive the pinion shaft **33** as hereinafter described with its integral pinion formation **34** meshing with rack **27**.

To the left (as represented in the drawings) of the knurled head **36**, the pinion shaft includes successively a short cylindrical portion **37** providing a shoulder **37***a* bearing against a corresponding end face of the right lug **32** and having near its middle a flat-bottomed circumferential groove **37***b*; a portion **38** journalled in the corresponding bore of lug **32**; the pinion formation **34**; a portion **39** still further reduced in diameter and journalled through bushing **40** in a corresponding bore of left lug **31**; and a threaded end **41**, with clamping wing nut **42**. The wing nut bears on the left side of lug **31** in clamping the router at selected adjustment.

A graduated sleeve **43**, rotatably mounted on shaft portion **37** between the shaft manipulating head or knob **36** and lug **31**, is however frictionally coupled with the shaft by an "O-ring" **44** located in groove **37***b*. Thus, with the pinion shaft stationary, the sleeve may be grasped at its knurled right end **43***a*, to set the series of circumferentially spaced graduations at its left end as desired to a conveniently located index mark **46** on the adjacent lug **32**. Preferably the scale divisions of the graduated sleeve are integral divisions reading in units of linear shift of the motor casing relative to the base corresponding to rotation of the pinion shaft.

A still further point of structure relating to easy, exact adjustment and clamping of the router for a desired tool position resides in the top end structure of motor casing member **10**, which has an undulating, upwardly extending rim formation resulting in four equispaced crests **10***a*. Each crest is shown located in angular sense midway between the successive external longitudinal rib enlargement **10***b* provided in the motor casing structure to accommodate bores for screws **12**. As the crests **10***a* are the extreme endward points of the casing terminating in a plane perpendicular to the axis of the router, and further are well spaced by location at the extreme outward radial extent of the member **10**, a stable supporting base is provided for the router when upended for adjustments.

When the router is upended on such stable base, not only are the graduated sleeve, clamping nut and pinion shaft the more easily manipulated for precise final adjustment of the tool, by virtue of the convenient steady position of the router; but also because the mass of the relatively light base is lifted rather than the much greater mass of the motor assembly the ease and precision of adjustment is furthered. For the latter reason also wear and tear on the rack and pinion mechanism is minimized.

The sleeve scale may be set exactly to "zero" by overcoming the "O-ring" frictional engagement without moving the pinion shaft; the wing nut **42** then loosened and the desired shift in tool position made by turning the pinion shaft to bring the corresponding scale graduation to the index **46**. Obviously at the user's option, the sleeve scale may be set to a reading corresponding in location to a desired shift, and the pinion shaft turned until the zero mark coincides with the index. Then the wing nut **42** is tightened to hold the pinion shaft stationary by the axially directed forces developed between the nut, shaft shoulder **37***a* and the respective abutting lug faces.

In furtherance of this clamping function, a pair of parallel circumferentially directed slots **47**, **48** cut through the wall of sleeve **20** at opposite sides of the lugs **31**, **32**, allow the pinion shaft to serve as a clamping bolt whereby the underlying sleeve area may be deflected to apply clamping force on the motor casing.

I claim:

1. In a portable electric router or the like having as a work engaging base a bottom-flanged generally cylindrical sleeve, a motor assembly having a cylindrical lower housing portion coaxially slidably telescoped in the base sleeve, and means for clamping the motor assembly and work engaging base in selected relative axial positions, that improvement comprising: a top motor housing end portion adapted to form a stable base for the router when upended thereon; a rack extending longitudinally on said motor housing portion; a pinion shaft carrying a pinion in engagement with the rack; integral lug means formed on the exterior of the base sleeve journalling said pinion shaft; said pinion shaft having opposite end portions projecting through said lug means, one projecting end being enlarged to provide a manipulating knob spaced from the lug means and an intervening cylindrical portion of reduced diameter providing a shaft shoulder bearing against an adjacent side of said lug means, the other projecting end of the shaft being threaded and provided with a clamping nut bearing on an opposite side of the lug means; said cylindrical portion having a circumferential groove between the knob and shoulder; a sleeve rotatably mounted on said cylindrical portion and having a series of circumferentially spaced graduations located for convenient reference with respect to an index mark on the base; and a friction coupling between the second said sleeve and shaft comprising an O-ring located in said groove.

2. In a portable electric router or the like having as a work engaging base a bottom-flanged generally cylindrical sleeve, a motor assembly with a cylindrical lower housing portion axially adjustably received in the base sleeve, and means for clamping the motor assembly and work engaging base in selected relative axial positions, that improvement comprising: a top motor housing end portion including at least three extreme angularly spaced endwise projections terminating in a common plane perpendicular to the motor axis and each projection radially spaced from the motor axis in a location adjacent the circumferential margin of the said end portion, whereby

the same is adapted to form a stable base for the router when upended thereon.

3. In a portable electric hand tool including a motor assembly having at one axial end a driven working element, that improvement comprising: a motor housing end portion at the other axial end of the assembly, said end portion including at least three extreme angularly spaced endwise projections terminating in a common plane perpendicular to the motor axis and each projection radially spaced from the motor axis in a location adjacent the circumferential margin of the said end portion, whereby the same is adapted to form a stable base for the tool when upended.

4. In a portable electric router or the like having as a work engaging base a bottom-flanged generally cylindrical sleeve, a motor assembly having a cylindrical lower housing portion coaxially slidably telescoped in the base sleeve, and means for clamping the motor assembly and work engaging base in selected relative axial positions, that improvement comprising: a rack extending longitudinally on said motor housing portion; a pinion shaft carrying a pinion in engagement with the rack; integral lug means formed on the exterior of the base sleeve journalling said pinion shaft; said pinion shaft having opposite end portions projecting through said lug means, one projecting end being enlarged to provide a manipulating knob spaced from the lug means and an intervening cylindrical portion of reduced diameter providing a shaft shoulder bearing against an adjacent side of said lug means, the other projecting end of the shaft being threaded and provided with a clamping nut bearing on an opposite side of the lug means; said cylindrical portion having a circumferential groove between the knob and shoulder; a sleeve rotatably mounted on said cylindrical portion and having a series of circumferentially spaced graduations located for convenient reference with respect to an index mark on the base, and a friction coupling between the second said sleeve and shaft comprising an O-ring located in said groove.

5. In a portable electric router or the like having as a work engaging base a bottom-flanged generally cylindrical sleeve, a motor assembly having a cylindrical lower housing portion coaxially slidably telescoped in the base sleeve, and means for clamping the motor assembly and work engaging base in selected relative axial positions, that improvement comprising: a rack extending longitudinally on said motor housing portion; a pinion shaft carrying a pinion in engagement with the rack; a pair of opposed integral lugs formed on the exterior of

the base sleeve journalling said pinion shaft at locations spaced axially on opposite sides of the pinion; said lugs being separated from each other and from the axially adjacent areas of the sleeve; said pinion shaft having opposite end portions projecting through said lugs, one projecting end being enlarged to provide a manipulating knob spaced from the adjacent lug and an intervening cylindrical portion of reduced diameter providing a shaft shoulder bearing against a side of said adjacent lug, the other projecting end of the shaft being threaded and provided with a clamping nut bearing on an opposite side of the other lug; said cylindrical portion having a circumferential groove between the knob and shoulder; a sleeve rotatably mounted on said cylindrical portion and having a series of circumferentially spaced graduations located for convenient reference with respect to an index mark on the base, and a friction coupling between the second said sleeve and shaft comprising an O-ring located in said groove.

6. In a portable electric router or the like having as a work engaging base a bottom-flanged generally cylindrical sleeve, a motor assembly having a cylindrical lower housing portion coaxially slidably telescoped in the base sleeve, and means for clamping the motor assembly and work engaging base in selected relative axial positions, that improvement comprising: a rack extending longitudinally on said motor housing portion; a pinion shaft carrying a pinion in engagement with the rack; and a pair of opposed integral lugs formed on the exterior of the base sleeve at opposite sides of said rack and journalling said pinion shaft at locations spaced axially from opposite sides of the pinion; said lugs being separated from each other and separated fro mthe axially adjacent areas of the sleeve; said pinion shaft having opposite end portions projecting through said lugs, one projecting end being enlarged to provide a manipulating knob spaced from the adjacent lug and an intervening shaft shoulder bearing against a side of said adjacent lug, the other projecting end of the shaft being threaded and provided with a clamping nut bearing on an opposite side of the other lug.

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