Nov. 9, 1965 L. J. HOFFMAN 3,216,032

TOOL WITH COUNTERBALANCED VERTICAL SPINDLE

Filed Feb. 25, 1963

Fig. 1

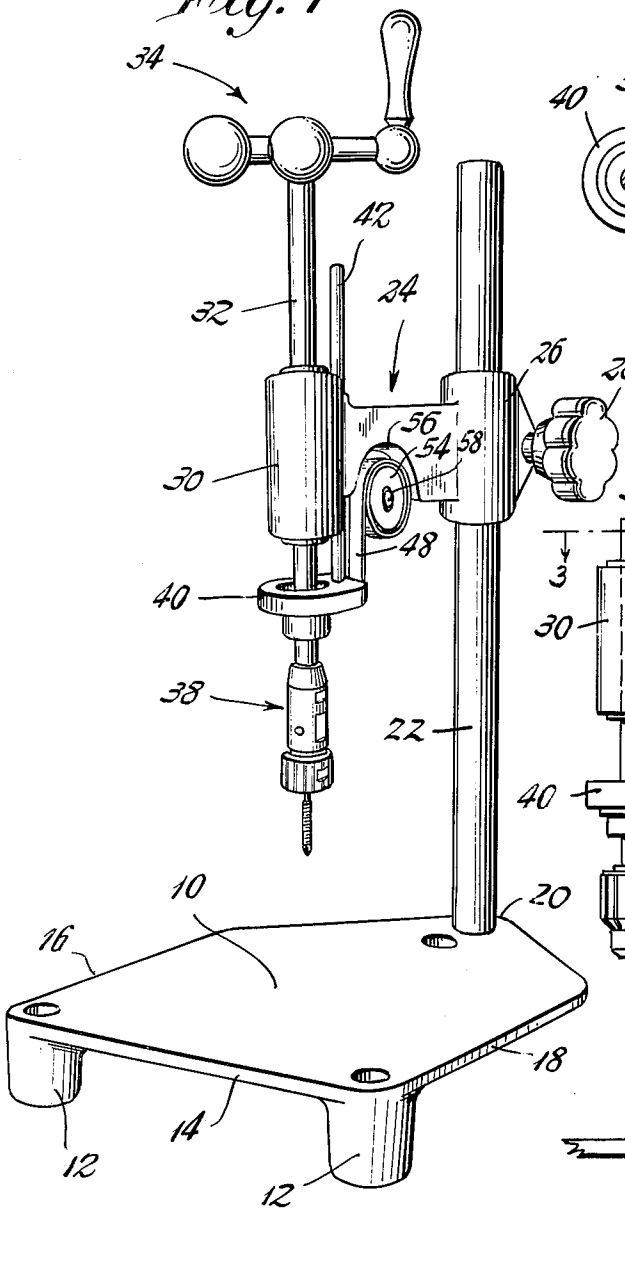


Fig. 3

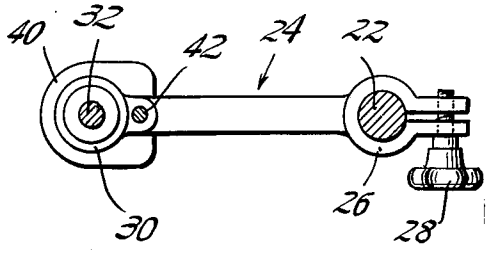
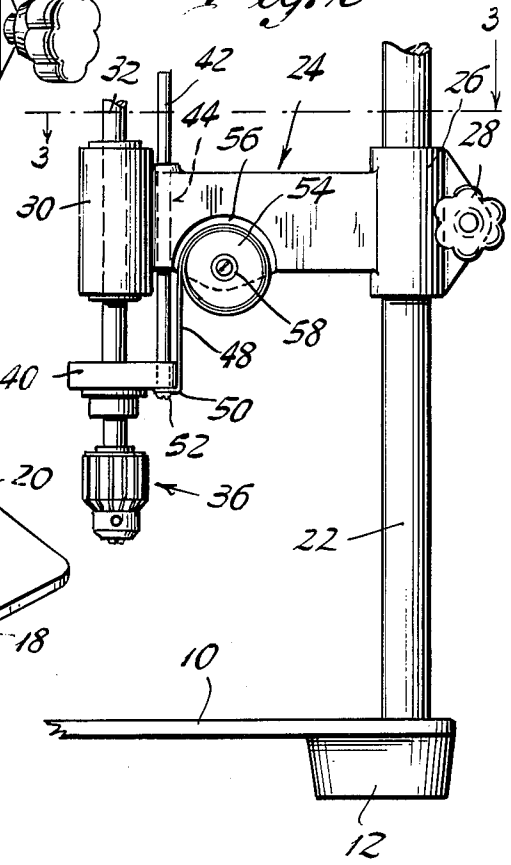


Fig. 2



INVENTOR.
LESLIE J. HOFFMAN
BY
H. Gilmer Lehmann
AGENT

United States Patent Office 3,216,032 Patented Nov. 9, 1965

3,216,032

TOOL WITH COUNTERBALANCED VERTICAL SPINDLE

Leslie J. Hoffman, % Orange Research, 821 Derby-Milford Road, Orange, Conn.

Filed Feb. 25, 1963, Ser. No. 260,519
2 Claims. (Cl. 10—129)

This invention relates to tools of the type having vertical spindles, such as hand-tapping tools, bench or floor-based tools (hand or powered) with vertical spindles and the like, and more particularly to tools of this kind in combination with spring or weighted counterbalance means for the spindles.

An object of the invention is to provide a novel and improved combination tool with vertical spindle and counterbalance spring means, wherein a constant counterbalancing upward force is exerted on the spindle at all times regardless of whether the latter is in a fully or a partially raised or lowered position.

Another object of the invention is to provide an improved tool as above set forth, which is extremely simple in construction and involves but few components, whereby its fabrication cost is low.

A feature of the invention resides in the provision of a novel tool and counterbalance combination in accordance with the foregoing, which is foolproof and reliable in its operation at all times.

A further object of the invention is to provide an improved combination tool as characterized, which is small and compact, and wherein the counterbalance means requires but little additional space.

Yet another object of the invention is to provide an improved tool combination as outlined, wherein the counterbalance means is fully accessible for cleaning, servicing and/or repair and replacement should the latter become necessary.

Still another object of the invention is to provide a novel hand tapper combination of the kind set forth, wherein the counterbalance means is incorporated in the spindle support arm and connected with the spindle part in the most advantageous and simple manner, utilizing components which may be readily fabricated by known procedures and which are sturdy and not likely to malfunction.

Other features and advantages will hereinafter appear.

In the drawings accompanying this specification, similar characters of reference have been used to designate like components throughout the several views, in which:

FIG. 1 is a front perspective view of an improved hand-tapping tool as provided by the invention.

FIG. 2 is a fragmentary side elevational view of the tool, this view showing a different type of chuck.

FIG. 3 is a fragmentary vertical sectional view taken on the line 3—3 of FIG. 2.

As shown, the improved combination tool and counterbalance device comprises a flat base 10 which is preferably constituted as a metal casting, the said base having a plurality of feet 12, preferably three in number, whereby the base will not rock or tilt but instead will remain stable even when placed on an uneven table surface. The base 10 is shown as having straight front and side edges 14, 16 and 18 respectively, and as having a pointed or tapered rear portion 20 provided with a relatively large bore in which there is secured an upright stanchion 22. The upright 22 may advantageously be constituted as a metal tube having an accurately finished cylindrical exterior surface.

Adjustably carried by the upright 22 is a horizontal arm 24, one end of said arm having a split collar 26 provided with a hand wheel 28 by which the arm 24 may be secured in various adjusted positions, spaced either a greater or lesser distance above the base 10.

The other end of the arm 24 has a hollow boss or bearing sleeve 30 in which there is turnably mounted a spindle 32, the latter being also axially, vertically movable in the bearing 30. Any suitable bushing or liner means may be provided in the boss 30, to provide a smooth bearing for the spindle 32.

At its upper end of the spindle 32 has a counterbalanced handle assemblage 34, by which the spindle may be readily turned in order to perform the desired machining operations such as drilling, tapping, reaming, etc.

The lower end of the spindle 32 is provided with means for accommodating various chucks, such as the Jacobs drill chuck 36 shown in FIG. 2, or else the Jacobs tapping chuck 38 shown in FIG. 1.

It will be understood that, in the assemblage as above set forth, the weight of the vertical spindle 32 and the operating handle 34, together with the chuck means provided at the lower spindle end will continually tend to shift the spindle downward under the action of gravity.

In acordance with the present invention, in combination with the organization above set forth there is provided an improved spring-type counterbalance means by which a continuous and uniform opposing force in an upward direction is applied to the spindle 32, regardless of whether the latter occupies a partially or fully raised or lowered position on the arm 24. The said counterbalance means further comprises relatively few components and requires but little space, being extremely compact while at the same time rugged and reliable in its operation.

As shown, the lower portion of the spindle 32 has a collar 40 which is turnably carried thereby, the said collar preferably having anti-friction bearing means (not shown) such as a ball bearing assemblage or the like. Rigidly affixed to the collar 40 is a guide rod 42, which extends upward from the collar and bears in a vertical bore 44 provided in the arm 24. The rod 42 extends above the arm 24, as seen in FIG. 1, and constitutes a means for preventing turning of the collar 40 when the spindle 32 is turned, while at the same time permitting the collar to follow the axial movements of the spindle.

Secured to the collar 40 is an elongate spring element 48 in the form of a hardened and tempered flat metal strip, which is so constituted that it normally tends to become coiled in a tight spiral. One end 50 of the spring element is secured to the collar 40, as by means of a screw 52 passing through an opening in the end, the latter being bent at a right angle as shown in FIG. 2. The screw 52 also is threaded into the guide rod 42, thereby to anchor the lower end of such rod to the collar 40. The spring element 48 extends upward alongside the guide rod 42 and coils around a turnable wheel 54 which is disposed in a recess 56 for the purpose of turnably mounting the wheel 54. The wheel is not fastened to the spring element 48, but the latter tightly coils about the wheel and since it tends to continually reduce its diameter, it snugly embraces the periphery of the wheel. Also, by virtue of the bias of the spring element, the portion of the latter which is not carried by the wheel 54 but which extends from such wheel along the guide rod 42 to the collar 40 of the spindle will at all times tend to become tightly coiled about the wheel 54. In consequence, with the wheel 54 mounted for free turning about the shaft 58, the action of the spring element 48 is such as to tend to turn the wheel and to exert a continuous and virtually unvarying upward force on the collar 40, which force in turn is transmitted to the spindle 32. Such upward force is constant by virtue of the fact that all portions of the spring element 48 tend to have the same biasing

action whereby they seek to assume a circular configuration having a diameter somewhat less than that of the wheel **54**.

The spring element **48** is arranged to exert a sufficient counterbalancing force on the spindle **32** so that the action of gravity on the latter will not cause it to descend of its own accord. That is, by virtue of the slight friction existing between the spindle **32** and the sleeve bearing **30** therefor, and the friction existing between the guide bar **42** and the bore **44** in the arm **24**, the spindle **32** will remain in any vertical position in which it is placed, even though a slight imbalance exists between the weight of the spindle assemblage on the one hand and the counterbalancing force exerted by the spring element **48** on the other hand.

The provision of such spring counterbalance means in the hand tapping or bench tool as above set forth is found to effect a number of advantages. Tapping operations may be easily and accurately carried out, as well as drilling and reaming operations, etc. The effect of gravity on the spindle assemblage is effectively offset, whereby any feed force imparted to the tool or bit performing the machine operation is not influenced but instead is a function of the actual downward force which may be applied on the spindle by the operator. Moreover, the action of the counterbalance spring means is essentially friction free and smooth, as well as being uniform in its effect, regardless of the raised or lowered position of the spindle.

The counterbalance means in the combination set forth is seen to be extremely compact, and to require but little additional space. Relatively few components are involved, and these may be readily economically fabricated and assembled. The counterbalance means is also fully accessible for cleaning, servicing, etc. and has been found to be extremely sturdy, accurate and reliable in its operation. As provided by the invention, the turnable wheel **54** and the spring element **48** which tends to coil about the wheel, together with the guide rod **42** and the collar **40** carried by the spindle are disposed out-of-the-way and do not detract in the least from the versatility of the tool. Instead, they greatly contribute to the satisfactory perfomance of the various machining operations desired.

While the invention is illustrated herein in connection with a hand powered bench tool, it will be understood that such showing is not to be considered as a limitation, and that the invention may be applied equally as well to power tools, either bench type or floor-based, such tools including vertical millers, drill presses, jig borers and the like.

Variations and modifications may be made within the scope of the claims, and portions of the improvement may be used without others.

I claim:

1. A machine tool comprising, in combination:

(a) a vertical spindle,
(b) an integral support arm in the form of a casting,
(c) said integral arm having at one end a bearing sleeve bore in which the spindle is carried and in which it has vertical axial movement and also turning movement,
(d) said integral arm having a recess formed in it adjacent the bearing sleeve, said recess being disposed both in the lower portion of one side and in an adjoining portion of the arm bottom,
(e) a horizontal stud rigidly carried at solely one of its ends, said stud being disposed on the arm in the said recess and being spaced from the sides of the recess,
(f) a wheel rotatably carried by the stud,
(g) a wheel retainer on the free end of the stud, removal of said retainer enabling the wheel to be removed axially from the said recess,
(h) a ribbon spring element normally tending to be tightly coiled around said wheel,
(i) the outer end of said element being coupled to the vertical spindle at a point below the arm, thereby to counterbalance the weight thereof,
(j) said spring element extending through the bottom area of said recess,
(k) said wheel and the coiled portion of the spring element projecting an appreciable distance below the bottom surface of the support arm whereby said projecting portions are accessible from all sides to enable easy handling of the spring and wheel for replacement purposes,
(l) said integral support arm having a bored guide hole parallel to the axis of the sleeve bore and disposed between the latter and the recess,
(m) a guide rod vertically movable in said guide hole and coupled at its lower end to the spindle to move vertically therewith,
(n) said outer end of the spring element being connected to said guide rod.

2. The invention as defined in claim **1**, wherein:
(a) the spindle has a collar in which it turns,
(b) said guide rod and outer end of the spring element being fastened to said collar.

References Cited by the Examiner

UNITED STATES PATENTS

1,577,975	3/26	Klausmeyer	77—36
1,977,546	10/34	Fornelius.	
2,215,224	9/40	MacMillan	248—123
2,232,146	2/41	Simmon	248—123
2,751,613	6/56	Lassy	10—129

ANDREW R. JUHASZ, *Primary Examiner.*