March 26, 1957 T. F. CARMICHAEL ET AL 2,786,950

VIBRATORY POWER TOOL

Filed Feb. 9, 1953 2 Sheets-Sheet 1

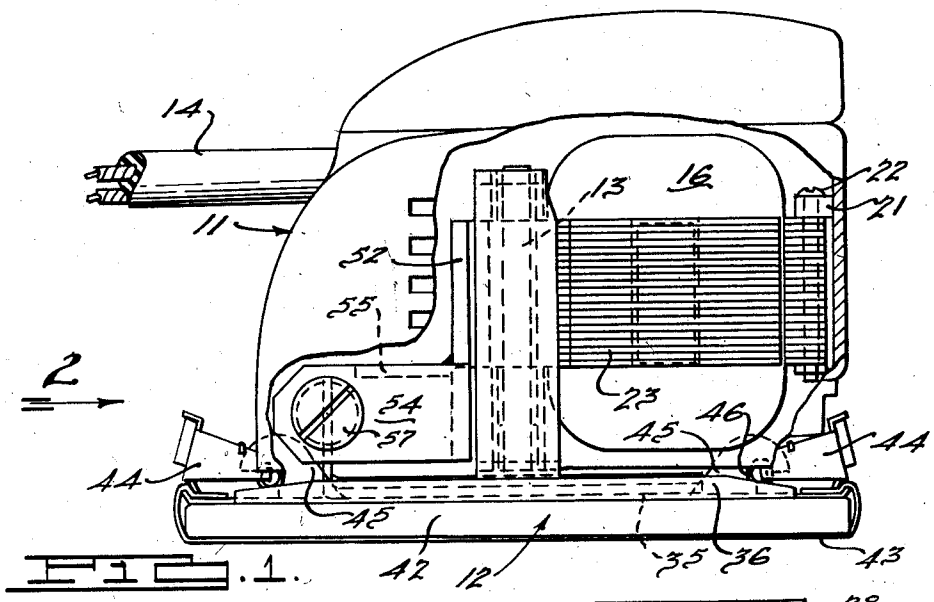


Fig. 1.

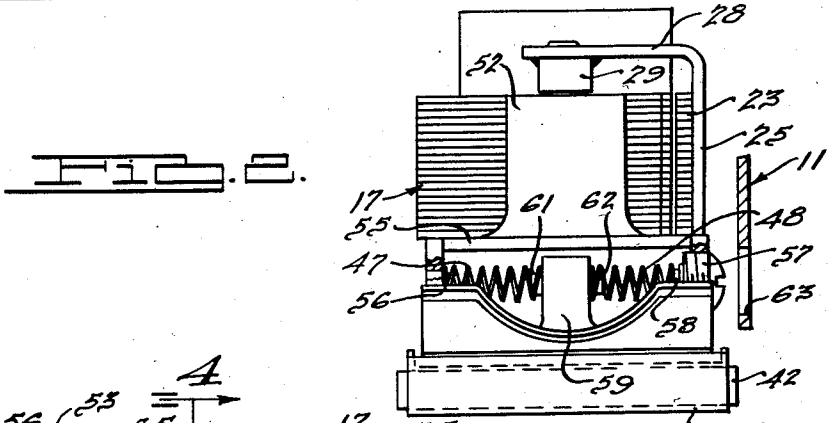


Fig. 2.

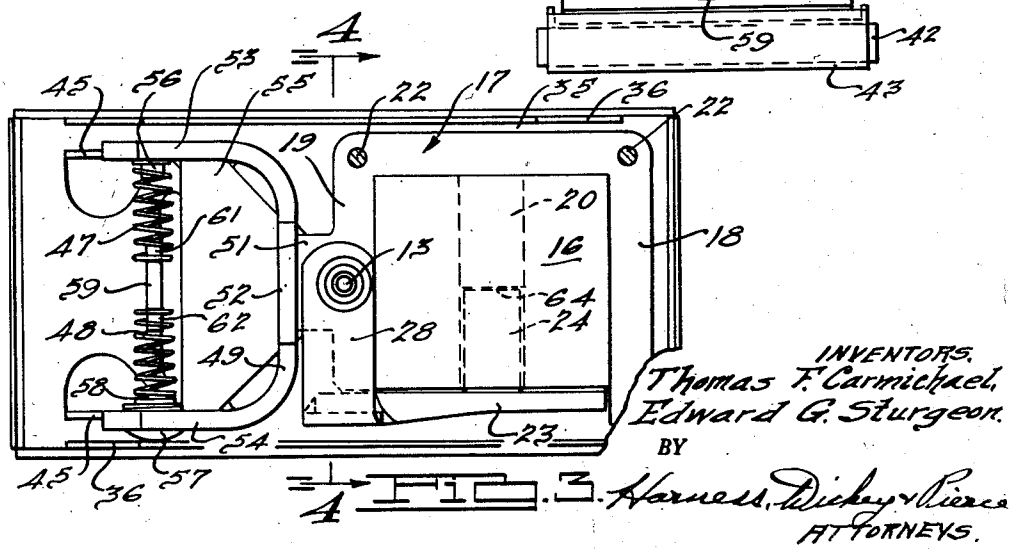


Fig. 3.

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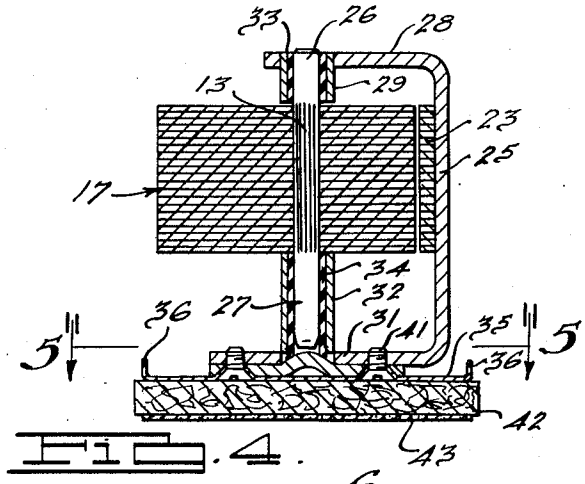


FIG. 4.

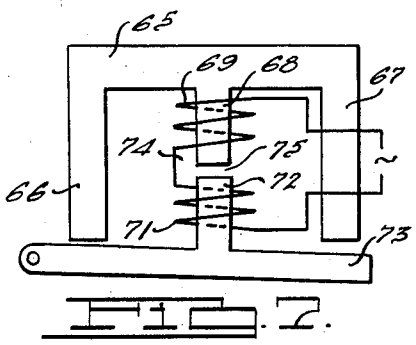


FIG. 7.

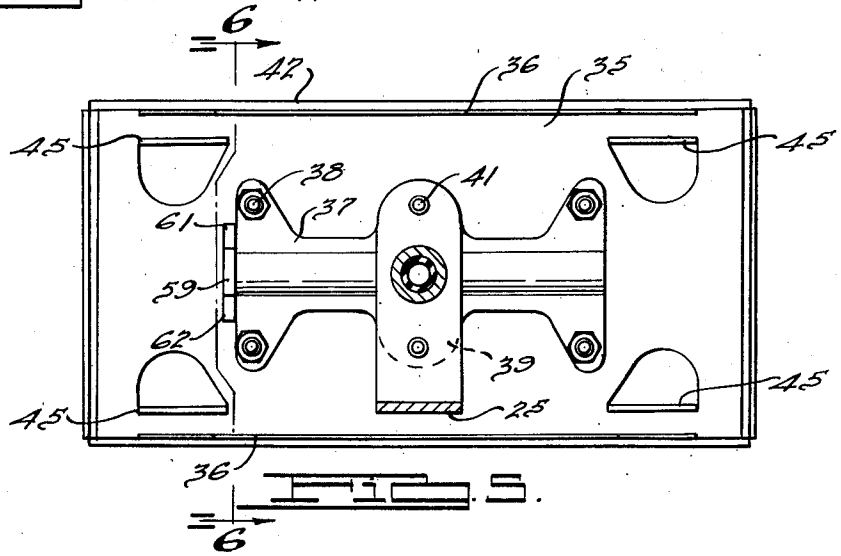


FIG. 5.

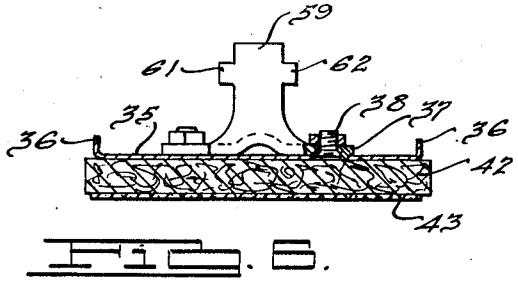


FIG. 6.

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VIBRATORY POWER TOOL

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Application February 9, 1953, Serial No. 335,902

10 Claims. (Cl. 310—17)

This invention relates to power tools, and more particularly to power driven hand sanders of the vibratory type.

It is an object of the present invention to provide an improved construction for a power operated vibratory hand sander which oscillates the sandpaper platen in a plane about a fixed axis, the vibrational movement being supplied by a pivoted armature and aided by a pair of opposed adjustable springs engageable with the vibrating part of the mechanism.

It is another object to provide an improved power operated hand sander of the above type in which the vibrating parts have greater dynamic balance so that an efficient working stroke is achieved, the dynamic bearing loads on the armature pivot supports being substantially minimized.

It is a further object to provide an improved power operated hand sander of the above character, in which the vibrating parts are resiliently supported so as to minimize the vibrational and jarring effects on the hand of the operator.

It is another objects to provide an improved power operated hand sander of the above nature, in which the opposed springs are supported in sapced relation with the housing held by the operator, whereby the vibrational forces affecting the springs are not directly transmitted to such housing, thereby enhancing the steadiness of operation and controllability of the device.

It is a further object of the invention to provide an improved power operated hand sander as described, in which a polyphase flux effect is produced by novel means, thereby increasing the motor efficiency and durability of stroke.

It is also an object to provide an improved power operated hand sander having the above characteristics, which is especially adapted for heavy duty work and which has a relatively compact arrangement of parts.

Other objects, features, and advantages of the present invention will become apparent from the subsequent description, taken in conjunction with the accompanying drawings.

In the drawings:

Figure 1 is a side elevational view of the improved sander of this invention, with parts broken away for clarity and showing the arrangement of the pivotal armature support and the platen;

Figure 2 is an end elevational view taken in the direction of the arrow 2 of Figure 1 with a portion of the casing removed, showing the supporting means and position of the springs;

Figure 3 is a top elevational view of the assembly with the casing removed showing the forked outer spring supporting member as well as the relation of the pivoted armature to the magnet;

Figure 4 is a cross-sectional view taken along the line 4—4 of Figure 3 with parts omitted for clarity and showing the pivoting means for the armature assembly including the resilient pivot supports;

Figure 5 is a plan cross-sectional view taken along the line 5—5 of Figure 4 with parts omitted for clarity and showing the means for securing the paper platen to the armature;

Figure 6 is a cross-sectional view taken along the line 6—6 of Figure 5 with parts omitted for clarity and showing the configuration of the center spring support; and

Figure 7 is a schematic view of a modified motor construction using a plunger and spaced-apart coils.

The invention comprises a sander having a shell-like housing generally indicated at **11** and a paper platen generally indicated at **12**, the platen being adapted to be vibrated in its own plane about the axis of a pivot pin **13** which supports the armature assembly of the sander motor. Housing **11** is of appropriately streamlined shape and has a power supply line **14** leading therefrom. The lower end **15** of the shell-like housing is open, and the paper platen **12** is supported outwardly of this lower end so as to vibrate in a plane parallel therewith.

The motor means for the platen comprises an electromagnet assembly having a coil **16** wound on a core generally indicated at **17**. The core in the preferred embodiment is of an E-shaped laminated construction having an outer side leg **18**, an inner side leg **19** and a shorter central leg **20**. Housing **11** is preferably secured to the magnet core **17** by means of ears **21** and a plurality of bolts **22**, two of which are shown in Figure 3 and which also serve to secure the laminations. The construction is such that the coil **16** and core **17** of the electromagnet are located at one side of the housing, and an armature **23** having a portion **24** projecting within coil **16** is pivotally supported by pin **13** for vibratory movement adjacent the electromagnet. In particular, armature **23** is of a laminated construction, and has a C-shaped pivot bracket **25** secured at one end thereof. The formation of the overall armature assembly is thus L-shaped as seen in Figure 3, with one leg extending from the center of the housing toward one of the long sides thereof and the other leg extending parallel to said long side and in facing relation with the operative face of said core. Pivot pin **13** is fixedly secured, by means such as a fluted central portion, to the inner leg **19** of core **17** at an intermediate portion thereof, and the pin has journal portions **26** and **27** projecting respectively above and below the core leg.

The upper arm **28** of C-shaped pivot bracket **25** is provided with a downwardly extending bearing sleeve **29** secured thereto and surrounding upper journal **26** of the pivot pin, and the lower arm **31** of the bracket has an upwardly extending bearing sleeve **32** secured thereto and surrounding journal **27** of the pin. As shown, lower sleeve **32** is of somewhat greater length than sleeve **29**, and rubber bushings **33** and **34** are disposed within sleeves **29** and **31** respectively. These bushings are preferbaly under compression and the arrangement is therefore such that upon movement of the armature torsional stresses occur in the rubber, with preferably no slippage on either the inside or outside diameters of these rubber bushings. This construction therefore affords a means of minimizing the transmission of jarring and vibrational effects from the armature to the magnet core and thus to the housing **11**.

Lower arm **31** of armature pivot bracket **25** is somewhat longer than upper arm **28** and has means as shown in Figures 4 and 5 for securing the paper platen **12** thereto. In particular, the platen comprises a flat bed plate **35** having upwardly turned side flanges **36** for strengthening purposes, and a mounting bracket **37** secured to the central portion of bed **35** by means of bolts **38**. The central portion **39** of bracket **37** is adapted to engage the underside of lower arm **31** of bracket **25** and is secured thereto

by a plurality of bolts 41 which also pass through bed 35. The underside of bed 35 has secured thereto a pad 42 which in turn is adapted to support a sandpaper sheet 43. Means are provided on platen bed 35 for securing the sandpaper thereto, this means in the present embodiment including a pair of clips 44 at opposite ends of the frame, pivotally supported by brackets 45 and being driven by springs 46 in a clamping direction, as shown in Figure 1. It will be understood that other types of paper securing means could be used if desired.

Means are provided for aiding the vibrational efficiency of the motor, and this means includes a pair of opposed helical springs 47 and 48 mounted so as to urge the armature 23 in opposite directions about its pivotal axis. The properties and relative proportions of these springs are such that a highly efficient and durable working stroke is obtained for the armature when under load, and these proportions may be such as are described in detail in Patent No. 2,632,121, dated March 17, 1953.

In the present invention, the springs 47 and 48 are located and supported in a novel manner which, as pointed out below, enhances the efficiency of operation of the unit and minimizes the vibrational effect on housing 11, thus making the construction particularly adaptable for heavy duty sanders. In particular, the springs are located on the side of armature pivot pin 13 opposite the side on which the armature itself is located. This is best seen in Figures 1 and 3, wherein it will be observed that the pivot pin 13 is located substantially in a central position with respect to the housing, and that the armature 23 is on one side of the pivot pin whereas springs 47 and 48 are on the opposite side.

The means for supporting the outer or stationary ends of springs 47 and 48 comprises a forked or C-shaped bracket 49 secured to inner leg 19 of core 17. Bracket 49 is secured to leg 19 by means of an enlarged portion 51 extending outwardly from an intermediate part of leg 19 and having an outer flat surface to which a flat tab 52 of bracket 49 is secured, by such means as welding. The bracket 49 is at a level somewhat below core 17, and the forked arms 53 and 54 of the bracket are substantially parallel and are spaced inwardly from the sides of housing 11. The arms may be strengthened by a web member 55 extending between these arms and the central portion of the bracket.

A pin 56 is secured to the outer end of arm 53 and supports the outer end of helical spring 47. Arm 54 has threadably mounted therein an adjusting screw 57 against which the outer end of spring 48 abuts, the spring being held in position by a pin 58 carried by screw 57. The inner ends of springs 47 and 48 engage a post 59 integral with and extending upwardly from one end of platen bracket 37, which as described previously is secured to armature pivot bracket 25. Post 59 is provided with tabs 61 and 62 for retaining the ends of springs 47 and 48 respectively.

It will thus be noted that springs 47 and 48 are supported so as to urge armature 23 in opposite directions during its vibrational movement. It will also be observed that the outer or stationary ends of the springs are not supported directly by housing 11, but are instead supported by a bracket secured to magnet core 17 and spaced from the housing. In this manner, the vibrational or jarring effect of the springs is not carried directly to the housing, but is at least partly absorbed by the mass of the magnet core structure to which the housing is attached. An access opening 63 is provided in the lower end of the housing opposite adjusting screw 57 so that the compression of the springs may be properly determined.

The operation of the device will be obvious from the foregoing description. Upon energization of magnet coil 16, armature 23 will be vibrated in the conventional manner by the changing flux field in core 17. The vibratory movement of the armature will move platen 12, which is secured to the armature by bracket 25, and the platen will thus vibrate in its own plane about the axis of pivot pin 13, to which the armature is pivotally secured by bracket 25. This movement will also cause post 59 to vibrate between the inner ends of opposed springs 47 and 48, the outer ends of these springs being held substantially by the arms of spring support bracket 49 secured to the magnet core. The vibrational characteristics of the springs will thus aid in producing an efficient working stroke for the paper platen as it vibrates. It will be noted that since the springs and the armature 23 are on opposite sides of pivot pin 13, the vibrational forces on paper platen 12 are substantially in dynamic balance about its pivotal axis, thus tending to minimize dynamic unbalancing forces on the pivot bearings and the housing.

The invention further provides novel means for lowering the power consumption and increasing the durability of stroke of the device by creating a polyphase flux effect on the armature 23. In the embodiment of Figures 1–6, this result is achieved by the presence of movable plunger 24 within a portion of the coil 16, the remainder of the coil surrounding central leg 20 of the core. Due to the air gap 64 existing between plunger 24 and core leg 20, leakage flux will exist which will cause the current in the portion of coil 16 surrounding core leg 20 to lag behind the current in the coil portion surrounding plunger 24. As a result, the armature 23 will be subjected to a prolonged force which will increase the durability of stroke and will decrease the power consumption under load.

Figure 7 illustrates in schematic fashion a modified arrangement of the motor in which the coil portions which surround the core leg and the plunger are physically spaced apart so as to enhance the leakage flux effect. In this figure, the core 65 has side legs 66 and 67 and a central leg 68 of shorter length on which the coil portion 69 is wound. In series with coil portion 69 and spaced axially therefrom is coil portion 71 which surrounds a plunger 72 projecting from armature 73. It will be seen that due to the leakage flux created by the space 74 between the coils as well as the air gap 75 between the plunger 72 and core leg 68, the polyphase effect will be increased, thereby enhancing the operational efficiency of the motor.

It should be noted that the polyphase flux effect produced by the novel plunger and air gap arrangement of this invention is similar to the phenomenon produced by the means described and claimed in Patent No. 2,362,121, dated March 17, 1953, although the means for producing said effect in the present application differs from that in the previous application.

While it will be apparent that the preferred embodiments of the invention herein disclosed are well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. A power operated vibratory tool comprising an electromagnet coil and a core therefor, a housing of rectangular shape secured to and surrounding said core, the core being disposed within one side of said housing with its operative face substantially parallel to the long axis of said housing, an L-shaped armature assembly having one leg extending from the center of said housing toward one of the long sides of said housing and the other leg extending parallel to said long side and in facing relation with the operative face of said core, means for pivotally supporting one end of said first leg for vibratory movement about an axis disposed substantially at the center of said housing, means for securing a tool to said armature for vibratory movement therewith, a pair of opposed springs for aiding the vibrational efficiency of said armature during operation, said springs being disposed within said housing on the opposite side of said pivot from said core and armature, means engageable by the opposed ends of said springs and connected to said armature, and means

connected to said magnet core and supporting the opposite ends of said springs.

2. In a vibratory power operated hand sander or the like, a magnet coil and a core therefor, a housing secured to and surrounding said core, one end of said housing being open, the core being disposed within one side of said housing, an armature adjacent said core and coil, means for pivotally supporting said armature, the axis of said pivotal support being transverse to the open end of said housing and being located substantially centrally of the housing, a paper platen secured to said armature for vibration therewith in its own plane about the armature pivot axis, said platen being disposed at the open end of said housing, a pair of opposed springs for aiding the vibrational efficiency of said armature and platen, said springs being disposed in the side of said housing opposite said magnet core, means secured to said armature and engageable by the opposed ends of said springs, and means secured to said magnet core and spaced inwardly of said housing for supporting the outer ends of said springs.

3. The combination according to claim 2, said pivot means comprising a pivot pin secured to said magnet core and extending outwardly from either side thereof, a pair of substantially parallel arms secured to said armature, bearing sleeves held by said arms and surrounding the outwardly extending portions of said pin, and a pair of rubber bushings disposed between said bearing sleeves and said pin.

4. The combination according to claim 3, said paper platen being secured to one of said parallel arms, whereby the platen vibrates together with said armature.

5. The combination according to claim 2, further provided with a post secured to and extending from said platen within said housing, the opposed ends of said springs being engageable with opposite sides of said post, whereby the forces from said springs are transmitted to said platen and armature.

6. The combination according to claim 2, the means for supporting the outer ends of said springs comprising a C-shaped member secured to said core and having substantially parallel arms extending within the other side of said housing and spaced inwardly from said housing walls, said outer spring ends being supported by said arms.

7. The combination according to claim 6, further provided with an adjusting screw threadably mounted in one of said arms for adjusting the compression in said springs, said housing having an access opening opposite said adjusting screw.

8. In a power operated vibratory sander or the like, a magnet coil and a core therefor, a housing secured to and surrounding said core, said housing having an open end, the core being substantially E-shaped and disposed within one side of said housing, an armature in facing relation with said coil and core, means for pivotally supporting said armature for movement about an axis transverse to the open end of said housing, said pivot means including a pin secured to said core at a central portion of the housing, a pivot bracket secured to said armature and having opposite arms, bearing connections between said arms and the opposite ends of said pivot pin, a paper platen secured to one of said arms adjacent the open end of said housing, a pair of opposed helical springs within

the side of said housing opposite said magnet coil and core, a post secured to said paper platen and extending within said housing, the opposed ends of said springs being engageable with opposite sides of said post, and means for supporting the outer ends of said springs, said means including a bracket having a central portion secured to said magnet core and a pair of arms spaced inwardly of said housing and engageable by said springs.

9. A power operated vibratory tool comprising an electromagnet coil and a core therefor, a housing secured to and surrounding said core, the core being disposed within one side of said housing and having an outer leg adjacent one end of said housing and an inner leg at the central portion of said housing, an armature pivotally supported on said inner leg for vibratory movement about an axis disposed substantially centrally of said housing, said armature being located within the same side of said housing as said core, means for securing a tool to said armature for vibratory movement therewith, a pair of opposed springs for aiding the vibrational efficiency of said armature during operation, said springs being disposed within said housing on the opposite side of said pivot from said core and armature, means engageable by the opposed ends of said springs and connected to said armature, and means connected to said magnet core and supporting the opposite ends of said springs.

10. A power operated vibratory tool comprising an electromagnet coil and a core therefor, a housing secured to and surrounding said core, the core being disposed within one side of said housing and comprising an outer leg adjacent one end of said housing and an inner leg at the central portion of said housing, an armature pivotally supported for vibratory movement about an axis disposed substantially centrally of said housing, said armature being located within the same side of said housing as said core, means for securing a tool to said armature for vibratory movement therewith, a pair of opposed helical springs under compression for aiding the vibrational efficiency of said armature during operation, said springs being disposed within said housing on the opposite side of said pivot from said core and armature, means engageable by the opposed ends of said springs and connected to said armature, and a pair of members secured to the inner arm of said magnet core and extending away from said pivot and said core, the outer ends of said springs being supported by said extending members.

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