July 22, 1969 H. A. HARRY 3,456,738

PORTABLE TOOL

Filed July 3, 1967 2 Sheets-Sheet 1

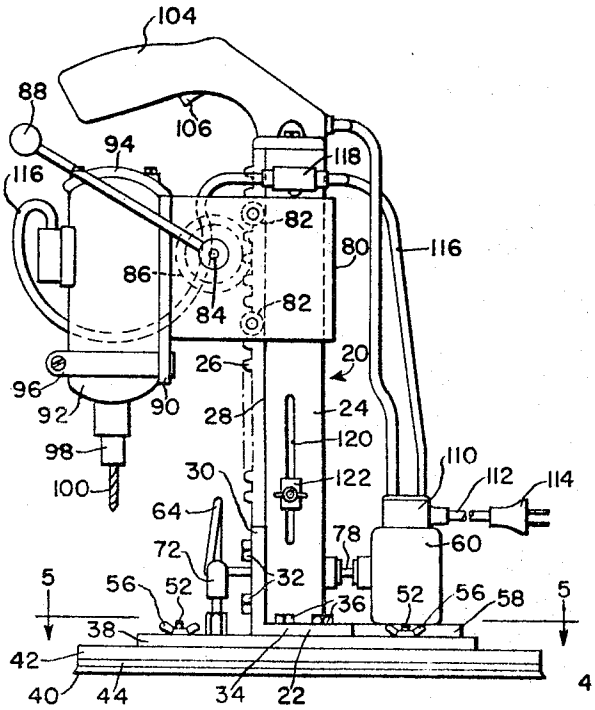


FIG. 1

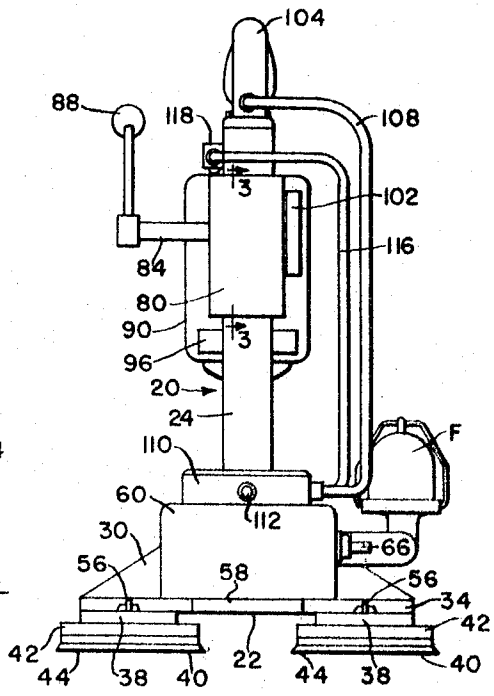


FIG. 2

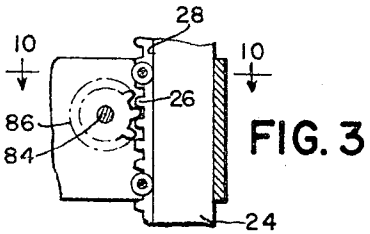


FIG. 3

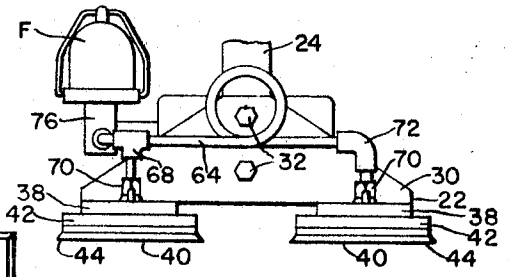


FIG. 4

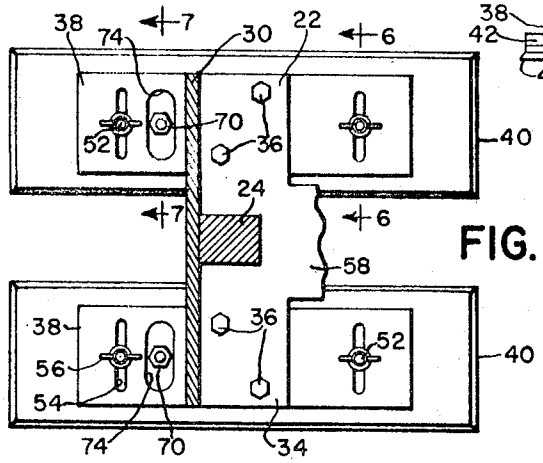


FIG. 5

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July 22, 1969 H. A. HARRY 3,456,738

PORTABLE TOOL

Filed July 3, 1967 2 Sheets-Sheet 2

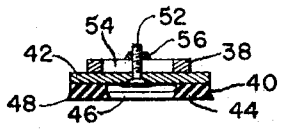


FIG. 6

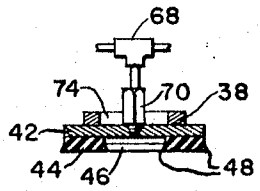


FIG. 7

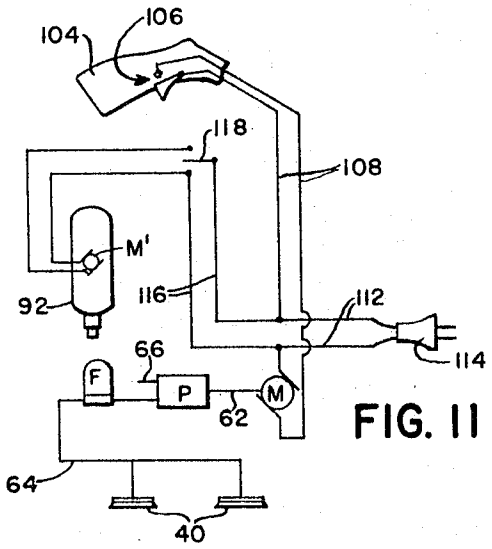


FIG. 11

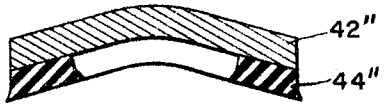


FIG. 8

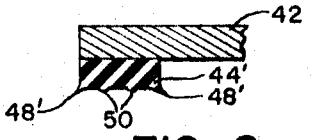


FIG. 9

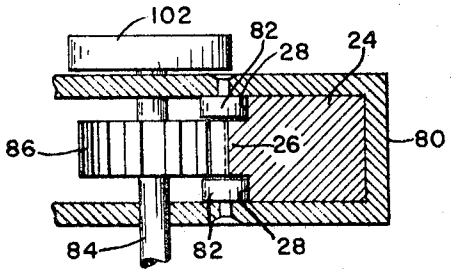


FIG. 10

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3,456,738

PORTABLE TOOL

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Filed July 3, 1967, Ser. No. 650,931
Int. Cl. E21c 5/00; E21 11/00
U.S. Cl. 173—18 4 Claims

ABSTRACT OF THE DISCLOSURE

A lightweight portable tool having adjustable fluid-pressure evacuated feet for attachment to a surface on which work is to be performed by a power appliance carried by the feet-equipped tool and featuring a self-contained electrically driven vacuum pump for evacuating the feet chambers and a pair of electrical switches, one carried by the tool for energizing the vacuum pump motor and the other being opened when the appliance is moved to a position away from the work and closed when the appliance is moved to a preselected position toward the work.

Background of the invention

A tool of the character disclosed herein finds principal utility in the construction or building field, especially on walls and other upright surfaces to which the tool may be temporarily vacuum-affixed so as to facilitate such operations as drilling, tapping, reaming etc. and applying screws and other fasteners, etc. It is known, of course, to exploit vacuum chambers in attaching feet in general but such known appliances involve mainly pneumatic tools entailing the use of long, heavy air hoses, which are also used to create the vacuum, and the tool thereby becomes heavy and unwieldy and substantially defeats its own purpose.

Summary of the invention

According to the present invention, an extremely lightweight portable tool is provided in which a self-contained tool-mounted vacuum pump, having its own electric motor, is employed, thus dispensing with the need for cumbersome air hoses and enabling the tool to be speedily and efficiently employed, particularly on walls and like surfaces where it would be otherwise difficult for the workman to locate and hold the tool while drilling, etc. This is especially true in the present-day rapid erection and fabrication of lightweight structures having sheet steel, plastic, etc., panels which are, according to modern methods, installed with self-drilling, self-tapping screws. In the preferred embodiment disclosed herein, the tool has a base from which rises a standard along which an electrically driven rotary tool is mounted for controlled movement toward and away from the work, together with an arrangement of electrical switch means for controlling the vacuum pump motor and the power tool motor. The tool has a control handle containing the switch for starting and stopping the vacuum pump motor and a second normally open switch is automatically closed after the support is located and vacuum-attached and when the tool is moved toward the work. Where the source of electrical energy is fairly remote from the work, it is necessary to use only a lightweight electrical line, because the vacuum pump, being driven by its own support-carried electric motor, does not need a separate vacuum line to a remote pump. The vacuum feet are provided as a spaced apart pair, with provision being made for selectively adjusting the spacing between the feet.

Description of the drawings

FIGURE 1 is a side elevation of the portable structure;

FIGURE 2 is an end elevation of the same;

FIGURE 3 is a section substantially along the line 3—3 of FIGURE 2;

FIGURE 4 is a fragmentary view seen from the end opposite to FIGURE 2;

FIGURE 5 is a section along the line 5—5 of FIGURE 1;

FIGURE 6 is a section on the line 6—6 of FIGURE 5;

FIGURE 7 is a section on the line 7—7 of FIGURE 5;

FIGURE 8 is a section of a modified form of vacuum feet;

FIGURE 9 is a section of a modified form of vacuum seal;

FIGURE 10 is a section on the line 10—10 of FIGURE 3; and

FIGURE 11 is a schematic view illustrating the electrical and vacuum circuits.

Description of the preferred embodiments

The portable structure comprises a support **20** including a base **22** and a standard or post **24** rigidly affixed to and rising from the base. The post is preferably of square section and is provided at one side with a toothed part or rack **26** flanked by a pair of longitudinal guide rabbets **28**. The base **22** is preferably in the form of an angle member having an upright flange **30** fixed to the post **24** by cap screws **32** and a bottom flange **34** fixed by cap screws **36** to a pair of parallel, spaced apart horizontal plates **38**. This structure is preferably made of lightweight steel, aluminum, etc., so as to keep the total weight of the tool quite low. With reference to the use of such directional terms as "horizontal," "upright," etc., it should be observed that these are used only for brevity and clarity and not by way of limitation, especially in view of the principal use of the structure on walls, etc., in which case the post or standard **24** would of course be horizontal.

The plates **38** serve to mount means comprising a pair of separate spaced apart feet **40**, each of which includes a flat metal member **42** to the underside of which is bonded or otherwise affixed a peripheral seal means **44** that affords a vacuum chamber **46** opening to the surface to which the structure attaches itself. The seal means **44** is preferably a continuous strip of flexible material such as soft pliant rubber and is bordered by peripheral inner and outer lips **48** to improve the sealing function. In a modified form of seal strip **44'** (FIGURE 9) the bottom of the strip may include a plurality of flexible ribs **50** intermediate peripheral lips **48'**. Although the flat members **42** and their associated seal means **44** are designed for use with flat surfaces, it is also possible to provide configured members and seals for use on, for example, corrugated walls, panels, etc. Such construction is illustrated in FIGURE 8, wherein a member **42''** is shown as being of arcuate section, as is its associated seal means **44''**. Other configurations will of course suggest themselves from the present disclosure.

The feet **40** are mounted respectively on the plates **38** so as to be selectively adjustable as to spacing and for this purpose each foot has a pair of upright threaded members **52** fixed to its member **42** and projecting upwardly through transverse slots **54** in the associated plate **38**. A wing nut **56** is threaded onto each threaded member **52**. These wing nuts may of course be loosened to enable selection of the spacing of the feet **40** and will be tightened to secure the feet against inadvertent movement.

The base flange **34** of the base **22** has an integral tongue **58** extending beyond the bottom of the post **24** and serving to rigidly mount a combined vacuum pump and electric motor unit **60**, the separate components of which are designated respectively as P and M in FIGURE 5, with the line **62** representing a drive shaft or equivalent means drivingly connecting the motor to the

pump. The pump-motor unit **60** may be of any type commercially available and the details form no part of the present invention, it being important, however, that the unit is carried directly by the support **20** and not at some remote location.

The air intake side of the pump P is connected by a line **64** to the feet **40** and a conventional filter F is interposed in this line. The pump exhaust is shown at **66**. The connection of the filter to the nearer end of the line **64** is effected by a T **68** having a suitable fitting **70** in communication with the vacuum chamber **46** of the associated feet **40** (FIGURE 7), and the other end of the line **64** is connected to the other end of the other vacuum chamber **46** by a similar fitting **70** and an elbow **72**. Because of the lateral adjustability of the feet **40**, the line **64** is in the form of a flexible hose having a coil therein to accommodate the feet spacing, and the plates **38** are slotted at **74** to accommodate the T **68** and elbow **72** (FIGURES 5 and 6). The fittings between the T **68**, filter F and pump P, as at **76** and **78** are rigid so as to support the filter without additional brackets.

A tool carrier **80**, herein the form of a U-shaped element, is carried by the post **24** in embracing relation thereto and includes a plurality of guide rollers **82** running in the post rabbets **28** (FIGURE 10) and a cross shaft **84** to which is fixed a pinion **86** meshing with the post rack teeth **28**. The outer end of the shaft **84** has a handle **88** by means of which the pinion **86** can be turned to cause the carrier **80** to run up and down the post **24**, the rollers **82** of course stabilizing the carrier so as to make its course accurate.

The front or open side of the carrier is closed by a mounting plate **90** rigidly attached thereto and serving to mount a power tool of the rotary type, here in the nature of a conventional so-called electric drill **92** including its own body-encased electric motor M' (FIGURE 11). The upper end of the tool body is attached to the plate by a bracket **94** and the lower end by a clamping band **96**. The tool has a chuck **98**, here shown as chucking a drill **100** but capable of chucking a variety of other tools as well as self-drilling and self-tapping screws and other fasteners, etc. The tool **92** as shown in FIGURE 1 is in its up or inactive position and is moved downwardly or toward the work to its working or active position. The end of the shaft **84** opposite to the handle **88** is biased in a clockwise direction by any suitable biasing means, such as clock type spring (not shown) wound within a housing **102** mounted on the carrier **80**.

In order to facilitate use of the tool, the upper end of the post **24** has rigidly affixed thereto a handle **104**, preferably of the piston-grip type in which is incorporated a biased-open electrical switch **106** electrically connected to the vacuum pump motor M as at **108** through a terminal box **110** mounted on the unit **60** and from which extends electrical conductor means **112** having a conventional pronged plug **114** for connection to a source of electrical energy.

The electrical conductor means includes additional conductor means **116** extending from the terminal box **110** to the drill motor M' through a biased-closed switch **118** mounted at the upper end of the post **24** and held open when engaged by the carrier **80** in its upper or inactive position.

The lower portion of the post **24** is slotted at **120** and carries vertically adjustable stop **122** for selectively limiting downward movement of the carrier **80** and thus of the tool **92**, as for limiting the depth of operation of the drill **100**, for example.

As described above, the entire structure is of extremely lightweight construction and materials and it is therefore relatively easy for the user to handle and position, especially on vertical surfaces such as walls, panels, etc. or on ceilings and the like. When the feet **40** are properly located, the user squeezes the handle switch **106** to close it and this energizes the pump motor M to evacuate the

foot chambers **46** and thereby to affix the tool structure to the floor, roof, wall, panel, ceiling, etc. The user then turns the handle **88** to rotate the pinion shaft **84** so as to move the tool **92** and carrier **80** toward the work, at which time the switch **118**, biased to close but held open by the carrier in its up position, closes and energizes the tool motor M'. When the work is accomplished, the operator causes the tool to return to its up position, again breaking the electrical circuit as the carrier **80** opens the switch **118** to stop the tool motor M', and when he releases the switch **106** it opens and breaks the circuit to the pump motor M, and the vacuum seal at the feet **40** deteriorates so that the tool structure can be removed and replaced at a new location.

Since the only remote connection is via the electrical conductor **112**, which may be of any length and which is comparatively light in weight and easy to handle, the portability of the tool is materially increased. The ability of the feet to be adjusted enables the feet to straddle intermediate obstacles such as beams, etc. and further enables the installation of fastener attachments of relatively large diameters or other lateral dimensions. Also, when the feet are constructed according to FIGURE 8 or variations thereof, adjustability of the feet accommodates configured panels, etc., of various pitches between peaks and valleys of the corrugations. The automatic switch means **118** further enhances the efficiency of the tool in use.

I claim:

1. A lightweight portable tool, comprising: a support having base means, foot means carried by the base means and including an under portion having peripheral seal means adapted to engage a surface and providing a vacuum chamber opening to such surface, a vacuum pump carried directly by the support means and having an air intake connected to and for evacuating the chamber, a first electric motor carried directly by the base and drivingly connected to said first motor, a power tool movably carried by the support for movement between active and inactive positions and including a second electric motor, electrical conductor means connected to the motors and adapted to be connected to a source of electrical energy and including first and second separate switches for respectively controlling the first and second motors, said first switch being manually operable to selectively start and step the first motor independently of the second motor and the second switch being arranged to be automatically opened and closed respectively according to the inactive and active positions of the tool.

2. The invention defined in claim **1**, in which the base means includes flat under surfaces, the foot means includes a pair of separate spaced apart feet disposed respectively beneath said surfaces, each foot having its own seal means and vacuum chamber connected to the pump intake, and means slidably adjustably mounting the feet on said surfaces for enabling selectively variation of the spacing between said feet.

3. The invention defined in claim **1**, including adjustable stop means cooperative between the support and tool for varying the location of the inactive position of the tool.

4. The invention defined in claim **1** in which the tool has a control handle and the first switch is carried by said handle.

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ERNEST R. PURSER, Primary Examiner

U.S. Cl. X.R.

77—7, 34.5, 34.6; 173—32