Dec. 6, 1955 R. J. HAUG 2,725,753

PORTABLE POWER OPERATED TOOL

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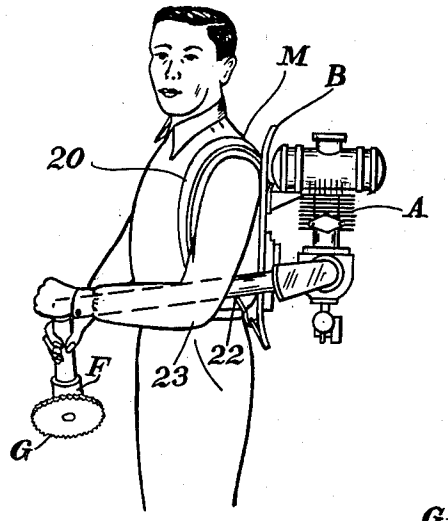


Fig. 1.

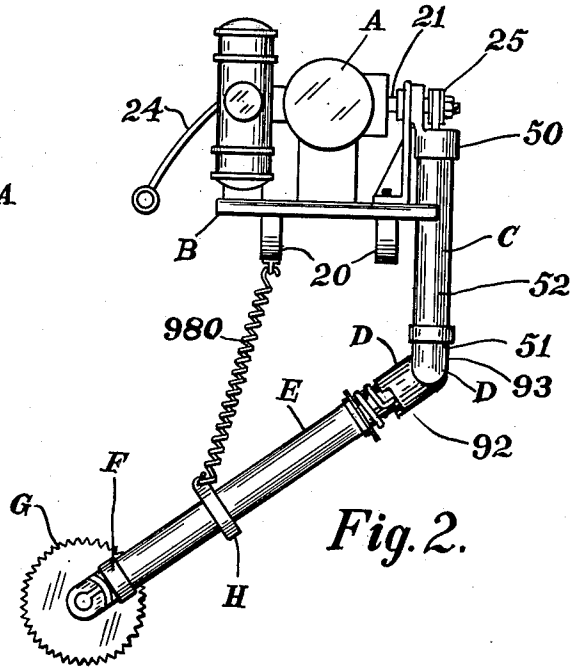


Fig. 2.

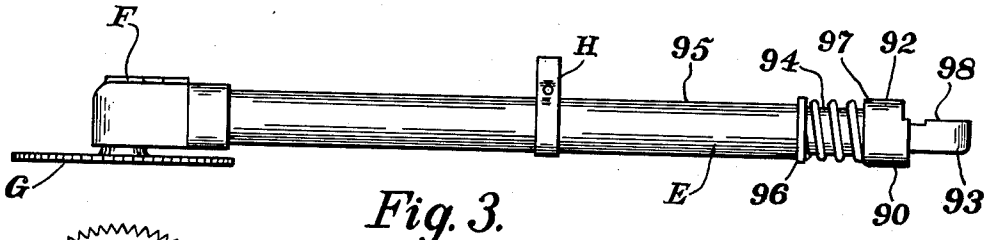


Fig. 3.

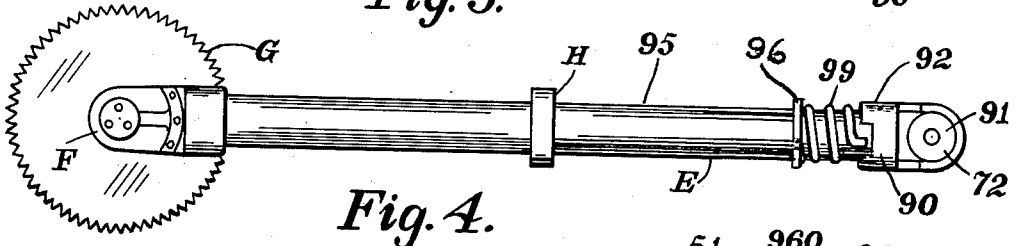


Fig. 4.
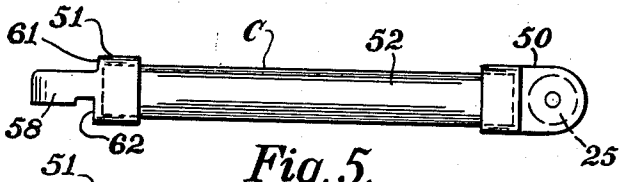


Fig. 5.

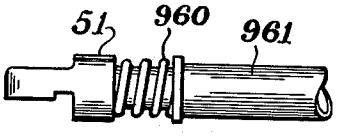


Fig. 5A

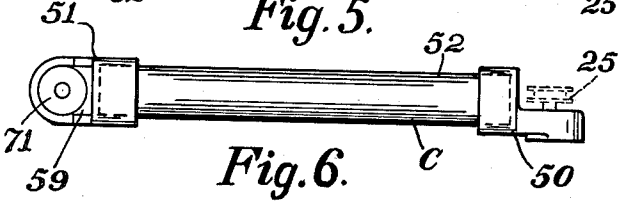


Fig. 6.

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PORTABLE POWER OPERATED TOOL

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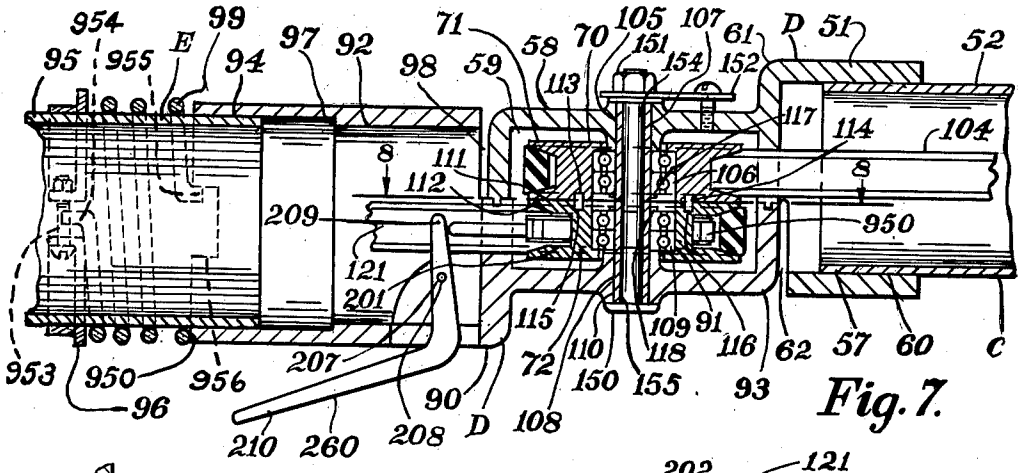


Fig. 7.

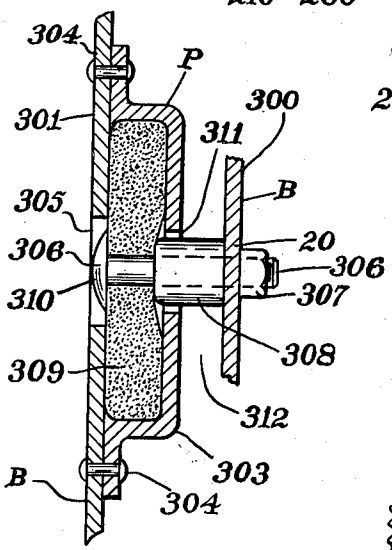


Fig. 9.

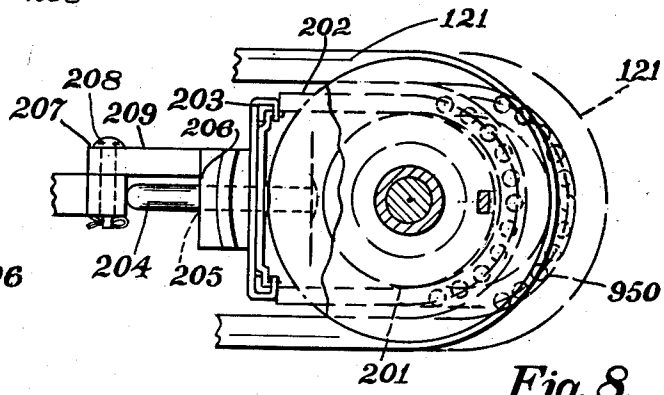


Fig. 8.

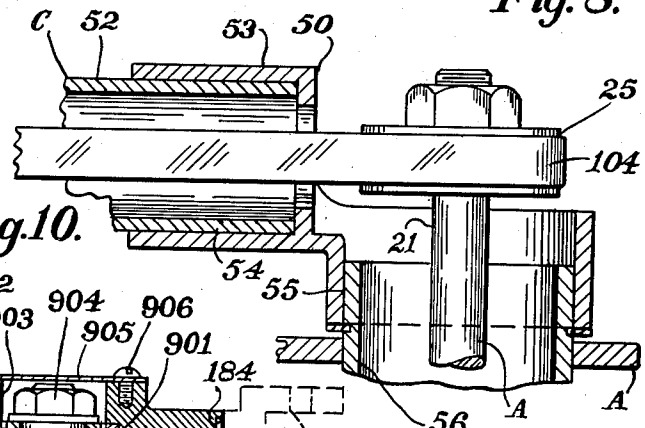


Fig. 10.

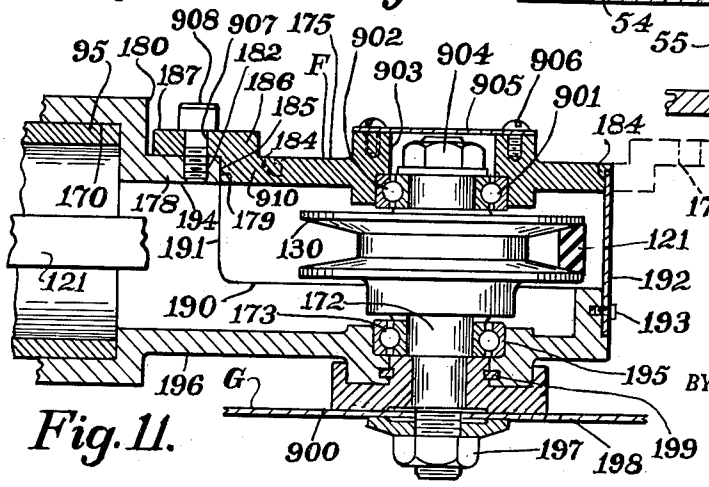


Fig. 11.

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Patented Dec. 6, 1955

2,725,753

PORTABLE POWER OPERATED TOOL

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Application July 18, 1951, Serial No. 237,462

13 Claims. (Cl. 74—16)

This invention relates to portable tools of the type in which a light internal combustion engine is suspended from the back of the user and a tool is powered therefrom by a movable power-transmitting member. My invention is especially adaptable and useful for powering a rotary cutting tool, such as a circular saw, when used to remove brush and small trees or for similar purposes.

The principal object of my invention is to connect such a tool with the engine by a single, lightweight, elongated handle made up of rigid, jointed casings which also serve as guides for operating the tool. Another object of my invention is to transmit power through said casings by means of V belts and pulleys rather than by rigid shafts or flexible shafts and thereby to achieve a reduction in cost of manufacture, an ease of replacement in remote brush covered areas and an unusually light weight at the tool head and in the power transmitting member.

Still another object of my invention is to articulate my rigid power-transmitting handle by providing a short rigid housing, vertically-pivoted to the engine and extending under one arm of the user to a knee joint, or hinge joint, in front of one side of said user, by mounting a horizontally-pivoted, longer, rigid housing on the knee joint which extends over beyond the other side of the user and by mounting the tool head for rotation around the free end of said longer housing. The rigid jointed housings thus are in a position to be grasped by both hands of the user, the tool can be raised or lowered with ease on the side of the user, opposite to said shorter arm, and if the user stumbles and falls the length and rigidity of the housings prevent his falling on the tool.

A further object of my invention is the provision of an improved vibrationless mounting for the engine on the back of the user and a novel eccentrically pivoted closure for the tool head which permits easy access when it is necessary to substitute a new belt. A still further object of my invention is the provision of a separable knee joint, intermediate of the rigid housings, whereby the longer housing can be detached when the device is being moved in an automobile, and the provision of a novel clutching and braking means, preferably associated with said knee joint.

I am aware that previous tools of this nature have used flexible shafts to transmit power, have had a rigid sleeve-like housing around a rigid power shaft and that separate rigid handles have been provided to serve as a guide, or operating control. I have found, however, that light flexible shafts tend to break down under a full day of use, such as in brush cutting, and stronger flexible shafts, or rigid shafts and gears tend to such weight that they quickly tire the user. I have also found that separate rigid handles and independent flexible shafts form a fork in which brush will catch and become lodged and also quickly tire the user. With my rigid jointed housings, and belt and pulley power transmission, the weight of the shorter housing is transferred to the back of the user, the longer housing is light and easily maneuverable into difficult places

and one hand of the user can be removed therefrom while still retaining full control by the other hand.

In the drawings,

Fig. 1 is a side elevation of my invention on the back of a user.

Fig. 2 is a plan view of my invention removed from the back of the user.

Fig. 3 is an enlarged front view of the elongated housing of my device detached from the device.

Fig. 4 is a plan view of the elongated housing shown in Fig. 3.

Fig. 5 is an enlarged front view of the shorter housing of my device.

Fig. 5A is a view similar to Fig. 5 of a modification.

Fig. 6 is a plan view of the shorter housing shown in Fig. 5.

Fig. 7 is an enlarged, fragmentary side view, in section of the separable knee joint and brake and clutch means of my device.

Fig. 8 is an enlarged plan view on line 8—8 of Fig. 7 illustrating the brake and clutch means.

Fig. 9 is an enlarged, fragmentary side elevation in section, of one of my new anti-vibration members for supporting the engine of my device.

Fig. 10 is an enlarged, fragmentary plan view in section showing the connection of the shorter housing to the engine and

Fig. 11 is an enlarged fragmentary side view in section of the eccentrically pivoted closure for the tool head of my device.

As shown in Figs. 1 and 2, the portable internal combustion engine A, of my device, is of a well known type. It is mounted on an anti-vibration means B, provided with suitable straps **20** whereby it can be easily supported on, or removed from, the back of a user M. The drive shaft **21** of engine A is preferably about opposite the waist **22** of the user M, and extends over to a point approximately in rear of the left elbow joint **23** of the user. The engine A is usually started by a rope or otherwise, before the device is placed on the user's back and its speed may be controlled by a convenient flexible connection **24** to the engine throttle.

The tool G of my device, such as the circular saw illustrated, is freely movable at the end of what I call an articulated, power-transmitting tool handle member shown at C, D, E and F in Fig. 2, the member preferably having a grip H for the right hand of the user M.

The first, or connecting section C of my articulated member, is a rigid, tubular housing, preferably of circular cross section and formed of a light weight metal. Housing C could obviously be formed of a one piece hollow tube, if desired, but for ease of manufacture and ease of varying the length thereof, I prefer to form the same with what I call a swing-head **50** and a knee joint head **51** of cast metal, separated by a metal tube **52** of the desired length.

Swing head **50** includes a recess **53** in which the adjacent end **54** of tube **52** is held, as shown in Fig. 10, and is provided with a recess **55** at its other end which is journalled on a fixed horizontal pivot **56** on engine A. Pivot **56** is located several inches behind the left elbow joint **23** of the user thus permitting the housing C to oscillate in a vertical plane around the left side of the user and, when extending forwardly of the user, positioning the tube **52** of housing C between the left arm and the body of the user. The drive shaft **21** of engine A is journalled at the centre of horizontal pivot **56** and extends to a driving pulley **25** fixed on the shaft at the longitudinal centre line of swing head **50**. It will be obvious that driving pulley **25** thus remains in the same relative position in housing C regardless of the position of oscillation in a vertical plane thereof.

Knee joint head **51**, of housing C, includes a recess **60** in which the adjacent end **57** of tube **52** is held, a shoulder **61**, a cut away portion **62**, and a flattened extension **58** provided with a pulley recess **59**. As shown in Fig. 7, knee joint D contains a double pulley **70**, with one half of said pulley **71** revoluble in recess **59** of the extension **58** of knee joint head **51** and the other half **72** of the pulley **70** revoluble in a similar recess **91** in the flattened extension **93** of the knee joint head **90** of housing E.

Knee joint head **90** of housing E is provided with an enlarged portion **92**, from which projects the flattened extension **93**, similar to **58**. **90** also includes an internal shoulder at **97**, a cut away portion **98** and a portion **94** of greater internal diameter than at **92** in which tube **95** of housing E is slidably and revolubly retained. An annular sleeve **96** is provided proximate the end of tube **95** and a coil spring **99** encircles tube **95** between sleeve **96** and the end **950** of head **90**. Sleeve **96** is of the split type and may be tightened into position on tube **95** by a bolt and nut shown at **953**. One end **954** of spring **99** is inserted in the split of sleeve **96** and the opposite end **955** is inserted in a cut out **956** in sleeve **96**. Coil spring **99** urges the pulleys **130** and **72**, located at opposite ends of housing E, away from each other, thus maintaining constant tension on the belt **2** connecting the pulleys.

I prefer to use an engine A, of the type having a horizontal drive shaft **21**, whereby double pulley **70** revolves in a plane at right angles to the plane of driving pulley **25**. Half pulley **71**, of pulley **70**, is operatively connected by a flexible quarter twist belt **104** to driving pulley **25**, the belt **104** being contained within tube **52** of housing C. Half pulley **71** is journalled on a sleeve **105**, by suitable bearings **106** and the sleeve is fixed in a hole **107** in the centre of extension **58** of knee joint head **51**. Similarly half pulley **72** is operatively connected by a flexible belt **121** to a driven pulley **130** in the tool head F, the belt **121** being contained in the tube **95**, of housing E. **72** is journalled on a sleeve **108**, identical with and aligned with sleeve **105**, there being suitable bearings at **109** and a hole **110** through the centre of extension **93** of knee joint head **90** of housing E in which sleeve **108** is fixed. The contacting ends of sleeves **108** and **105** are flush with the adjacent diametrical surfaces **111** and **112** of their respective half pulleys **72** and **71** and driving pins **113** and **114** project from one of said diametrical surfaces such as **111** into registering driving pin holes **115** and **116** in the opposite diametrical surface such as **112**. Spring rings, **117** and **118** of a well known type are also provided to retain the half pulleys on their respective sleeves when the knee joint is separated.

A headed bolt **150**, having a nut **151**, retained by a leaf spring **152**, passes through the central openings **154** and **155** of sleeves **105** and **108** to detachably retain knee joint head **90** of E on knee joint head **51** of C. It will be apparent that knee joint D permits housing E to oscillate horizontally on a vertical pivot formed by sleeves **105** and **108** and bolt **150**. Also that when the knee joint D is assembled in operating position, half pulley **71** which is rotated by belt **104** from driving pulley **25**, will through driving pins **113** and **114**, in turn rotate half pulley **72** and the latter, through belt **121**, will rotate driven pulley **130** in tool head E.

When the device is not in use, leaf spring **152** may be flexed, nut **151** unthreaded from bolt **150** and knee joint head **58** with its sleeve **105** and half pulley **71** may be slid off bolt **150** to detach the elongated housing E from housing C.

Tool head F, like the other parts of my new articulated tool handle, is preferably of light weight metal and may be a casting having a recess **170** in which tube **95** is fixed as shown in Fig. 11. The front and side walls of tool head F are cut away on horizontal line **190** and vertical line **191** and are replaced by a curved metal plate **192**, removably secured to the tool head F by bolts **193**. The upper wall **178** of tool head F is cut away to form a curved edge **179** and includes a flat shelf portion **194**, provided with threaded bolt holes **182**, and a curved vertical shoulder **180**.

A driven pulley **130** is mounted on shaft **172**, the shaft **172** being journalled in suitable lower bearings **173** in a bearing recess **195** intermediate of lower wall **196** of tool head F. A tool G, such as a circular saw, is fixed to the outer threaded end of shaft **172** by a nut **197** and collar **198**, the collar having a packing ring **199**, and an upturned flange **900** arranged to prevent fouling of the shaft with leaves or grass.

I provide an eccentrically swivelled cover **175**, as an upper closure for tool head F, cover **175** having a bearing recess **901** for the upper bearings **902** of shaft **172** and a recess **903** for an upper nut **904**, the nut **904** being threaded on the upper end of shaft **172**. A cover **905** is removably secured by bolts **906** over recess **903**. Swivel cover **175** is thus rotatably mounted on shaft **172** and can be swivelled in an arc of 180° to the position shown in dotted lines.

Swivel cover **175** has one curved peripheral edge **184** at a less distance from shaft **172** than its opposite curved peripheral edge **185**, edge **184** fitting within plate **192** and edge **185** conforming to and abutting on the curved edge **179** of wall **178**. A flange **186** projects upwardly from edge **185** and thence outwardly at **187** to overlie portion **194** of wall **178**, unthreaded bolt holes **907** being provided in **187** to register with bolt holes **182** of portion **194**.

In the event that a belt such as **121** requires replacement, plate **192** is removed by unthreading bolts **193** and bolts **908** are unthreaded from holes **182** in wall **178**. Cover **175** may then be swivelled on shaft **172** to the dotted line position leaving a space **910** between edge **184** and cage **179**. A new belt, such as **121**, is then passed through tube **95** so that its end loop projects out of space **910**, thus permitting cover **175** to be refastened by bolts **908** and the end loop of the belt to pass over the cover and onto pulley **130**. Plate **192** is then replaced and the substitution of belts complete.

Since tube **95** is preferably fixed at one end to tool head F and is slidably and revolubly mounted at its other end in the portion **94** of knee joint D, the user can rotate tool head F around the longitudinal axis of housing E by means of grip H and thus change the angle of the tool G.

I provide a novel clutch and brake means as shown in Figs. 7 and 8 which preferably is associated with one of the half pulleys of knee joint D such as **72** for convenience of access, although it could obviously be associated with pulley **25**. As shown a groove **201**, with perpendicular side walls, is formed at the base of the V groove in a half pulley, such as **72** of knee joint head **90** of housing E. A U-shaped strip of spring steel **202** is retained within the groove but is of suitable cross section to prevent its bearing on the bottom or sides of the groove **201** or the inner surface of the flexible V belt **121** with undesirable friction. The ends of strip **202** are retained in a transverse rigid retaining element **203**, positioned to advance and retract within recess **91** of extension **93** of **90**. Element **203** is fixed to a rod **204**, passing through a hole **205** in the wall **206** of **91** and into the interior of the enlarged portion **92** of knee joint head **90**. A bell crank lever **260**, hinged at **207** on a pin **208** has its shorter section **209** in contact with the free end of rod **204** and its longer section extending outside of **92** to form a hand control lever **210**.

I provide a plurality of rollers **950** in the V-shaped strip **202** arranged to provide rolling contact with the inner surface of belt **121** and thereby to prevent stalling of the engine A during the initial contact of the strip with the belt.

When lever **210** is pressed inward, rod **204** and ele-

ment 203 advance the resilient strip 202 out of groove 201 and carry rollers 950 into contact with the inner surface of belt 121 thus separating the belt from the pulley. Upon further pressure of lever 210 the strip 202 completely disengages the belt 121 from the pulley 72 and forces it against the walls of the recess 91 thus stopping the movement of the belt entirely and permitting the pulley to continue revolving. The coil spring 99, which keeps the belt 121 taut within casing E by continually pressing on sleeve 96, returns the belt to its normal position on the pulley 72 when pressure on lever 210 is released and the belt forces the parts of the clutch and brake device back to their normal positions.

As shown in Fig. 9, my anti vibration means B includes an engine plate 300 upon which engine A is rigidly mounted. It also includes a back plate 301 to which the straps 20 are attached. To support engine A, without vibration transmitted to the user M, and with a heat insulation space between engine and user anti-vibration spacers P are provided, between the plates 300 and 301. I attach an inverted cup 303 to the back plate by rivets or bolts 304 the cup having a central opening 311 and the back plate having a similar opening 305. A carriage bolt 306 is attached to the engine plate 300 by a nut 307 and passes through a spacer 308 into a soft rubber insert 309 retained in place by cup 303. The bolt head 310 is accommodated by the opening 305 in back plate 301 and it will be apparent that the metal engine plate 300 and the bolt 306 do not contact the back plate 301 but are connected thereto only by the soft rubber insert 309 which absorbs engine vibration at the same time that it supports the engine A on the user's back. An air space 312 is also provided between engine plate 300 and back plate 301 to insulate the user M against the heat of the engine A.

In operation, it is first necessary to attach housing E to housing C if it has been detached for carrying. The knee joint head 51 of housing C is placed on knee joint head 90 of housing E so that pins 113 and 114 enter holes 115 and 116 and sleeve 105 slides onto bolt 150 until flush with the end of sleeve 108. The nut 151 is then placed on bolt 150 to complete the assembly of knee joint D. The engine A may then be started, and placed on the user's back, being separated therefrom by my anti-vibration means B. The housing C passes under the left arm of the user to bring the knee joint D in front and to the left of the user in convenient reach of the left hand of the user. Housing E extends over to the front right side of the user, with grip H in convenient reach of the right hand of the user. The user's left hand also encircles hand lever 210 and presses upon the same to detach the belt 121 from pulley 72 until it is desired that the tool G revolve. The throttle may be controlled by the right hand of the user by means of flexible connection 24. The tool G can be raised or lowered on the swing-head 50 as a pivot or moved forward and backward on the knee joint D as a pivot while in any position the tool head is rotatable about housing E. In addition, by the user leaning forward or backward, even greater movability of tool G is achieved.

As shown, housing C is not rotatable on its longitudinal axis although such rotation could be secured by constructing it in the manner of housing E as indicated in Fig. 5A. I prefer the construction shown in Figs. 5 and 6 because I find the tool G is freely movable and easily guided when only the housing C is capable of revolving on its longitudinal axis. In Fig. 5A a coil spring 960 similar to 99 and a flanged tube 961, similar to 95, are substituted for the tube 52 thus providing automatic tensioning of the belt and rotation on the longitudinal axis similar to housing E. Since belt 121 is not twisted in its normal position, it can be twisted by the rotation 10 of tool head F at least through a quarter twist in either direction if desired without affecting the transmission of power.

I may provide an arcuate elongated slot 970 in tube 95, and an upstanding pin 971 on tube 94 of housing E, the pin being movable only to the limits of the slot and thus preventing the rotation of tool head F to the point of crossing of the belt 121. I may also provide a coil spring 980 between the straps 20 and the housing E, as shown in Fig. 2, to counterbalance the weight of housing E, tool head F and tool G.

It is obvious that my device can be adapted for use by a left handed person mounting the engine A, to bring the drive shaft 21 over to the right side of the user, whereby housing C will pass under the right arm and hand grip H be positioned for the left hand of the user.

Obviously the clutch control handle 260 can be arranged by suitable springs so that the clutch is normally disengaged and is engaged only when the operator presses the handle 260.

It is also obvious that I could provide a short belt connection between the power pulley 25 and a pulley mounted on the engine shaft 21 to facilitate substitution of various sizes of pulley thereby securing a variety of power ratios.

I claim:

1. A power operated portable tool comprising an internal combustion engine; means for supporting said engine on the back of a user; a short, rigid hollow mechanical power-transmitting housing, pivoted to said engine for oscillatory movement in a first single plane, and extending forwardly under an arm of said user to a point in front thereof; an elongated, rigid hollow mechanical power-transmitting housing, pivoted at the free end of said short arm for oscillatory movement in a second single plane substantially at right angles to said first plane and extending to a tool head and said tool head, including a tool, rotatably mounted at the end of said elongated housing, to turn around the longitudinal axis of said housing.

2. A power operated tool, comprising an internal combustion engine; means for supporting said engine on the back of a user; a hinge jointed, tubular handle extending forwardly from, and having one end pivotally supported by said engine, a rotary tool mounted to rotate around the opposite end of said handle and belt and pulley power transmission mechanism substantially wholly contained within said handle for operatively connecting said engine with said tool.

3. A power operated tool, comprising an internal combustion engine; means for supporting said engine on the back of a user; a hinge jointed handle formed of a pair of rigid, tubular housings extending forwardly from, and having one end supported by said engine, a rotary tool mounted to rotate around the opposite end of said handle; belt and pulley power transmission mechanism substantially wholly contained within said handle for operatively connecting said engine with said tool and power disconnecting and connecting clutch means, located within one of said housings and operable from outside the same for removing a belt from, and returning said belt into, engagement with a pulley of said power transmission mechanism.

4. A power operated portable tool comprising an internal combustion engine; means for supporting said engine on the back of a user; a short, rigid tubular housing pivoted to said engine for vertical oscillatory movement and extending forwardly to a knee joint in front of a side of said user; an elongated, rigid tubular housing pivoted at said knee joint for horizontal oscillatory movement and extending to a tool head; said tool head, including a tool, rotatably mounted at the end of said elongated housing; and mechanical power transmitting means within said tubular housings comprising a driving pulley powered by said engine and axially aligned with the horizontal pivot of said short housing; a driven pulley in the tool head, operatively connected to the tool; a double pulley in the knee joint, at right angles

to said driving pulley; a flexible belt connecting the driving pulley with one half of said double pulley and a flexible belt connecting the other half of said double pulley with said driven pulley.

5. The machine described in claim 4 plus quick release means for disengaging said housings at the knee joint, said means including inter-engaging elements on each half of said double pulley.

6. The machine described in claim 4 plus an eccentrically swivelled cover on said tool head adapted to form a belt opening when in open position.

7. The machine described in claim 4 plus clutch and brake means, associated with one of said pulleys and adapted to contact and move a driving belt out of contact with the belt groove in said pulley and into contact with the inner walls of the pulley recess.

8. The machine described in claim 4 plus anti-vibration means between said engine and the user's back, said means comprising a back plate provided with inverted cups, each having a central bolt opening therethrough; an engine plate having projecting headed bolts each extending into one of said cups through said opening and each having a spacing sleeve therearound and a soft rubber insert, encircling each bolt between the head and an end of the spacer sleeve, and wholly retained and supported within said inverted cup.

9. A mechanical power transmitting handle comprising a short, rigid tubular housing and an elongated rigid tubular housing connected together by the pivot pin of a knee joint; a double pulley mounted on the pivot pin of said knee joint; a driving pulley at right angles to said double pulley and located at the opposite end of said short housing; a quarter-twist belt connecting said driving pulley with one half of said double pulley; a driven pulley mounted to rotate around the opposite end of said elongated housing and a flexible belt connecting said driven pulley with the other half of said double pulley.

10. A mechanical power transmitting handle comprising a short, rigid tubular housing and an elongated, rigid tubular housing; a knee joint including a pivot pin, connecting the adjacent ends of said housings; a double pulley mounted on the pivot pin of said knee joint; a driving pulley at right angles to said double pulley and located at the opposite end of said short housing; a quarter-twist belt operatively connecting said driving pulley with one half of said double pulley; a driven pulley mounted to rotate around the opposite end of said elongated housing; a flexible belt operatively connecting said driven pulley with the other half of said double pulley and means for quickly engaging and disengaging the adjacent ends of said housings at said knee joint.

11. In a portable power operated tool, adapted to be bodily transported and used by a single individual, the combination of a gasoline engine having a drive shaft with a pulley at the terminal end thereof for powering said tool; an elongated hollow tubular member, of rigid material, said member having one end pivoted to said engine to rotate in a single plane around the central longitudinal axis of the drive shaft and pulley; an elongated hollow sleeve of rigid material having hand grip means thereon and mounted to rotate around the central longitudinal axis of said member adjacent the free end thereof; a tool head having a tool on the exterior thereof and a pulley, operably connected to said tool, in the interior thereof, said tool head being fixed at the terminal end of said sleeve, and a flexible belt trained around said drive shaft pulley and said tool head pulley and substantially entirely enclosed within said tool head, sleeve and tubular member.

12. A mechanical power transmitting handle, for use in guiding and driving a cutting tool at a distance from a portable engine, said handle comprising an elongated, hollow, tubular body of self supporting rigid material; a pair of heads, each fixed at an opposite end of said body but angularly disposed around the central longitudinal axis of said shaft at an angle of 90° from each other; a pair of pulley shafts, each journalled in one of said heads and extending normal to said body axis but angularly disposed therearound at an angle of 90° from each other, a pair of pulleys each revolvable with one of said shafts and each positioned opposite an opposite end of said tubular body and a flexible belt trained around said pair of pulleys and quarter twisted intermediate thereof for transmitting power from one said head to the other while substantially enclosed and protected by said body member.

13. A mechanical power transmitting handle for use in guiding and driving a cutting tool at a distance from a portable engine, said handle comprising an elongated hollow tubular body of self supporting rigid material; a drive head mounted at one end of said body and including a pulley drive shaft normal to the longitudinal axis of said body and a drive pulley at the terminal end of said shaft opposite the end of said body; a tool head mounted at the other end of said body and including a pulley driven shaft normal to the longitudinal axis of said body and a driven pulley at the terminal end of said driven shaft opposite said other end of said body; a pivot connection between said tool head and said body for enabling the turning of said head angularly around the central longitudinal axis of said body and a flexible belt, trained around said drive pulley and said driven pulley and substantially entirely enclosed within said body for transmitting power between said pulleys and inside said handle.

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