

March 7, 1933.

G. E. HAMPTON

1,900,553

PORTABLE MOTOR DRIVEN SAW

Filed Feb. 4, 1931

4 Sheets-Sheet 1

Fig. 1.

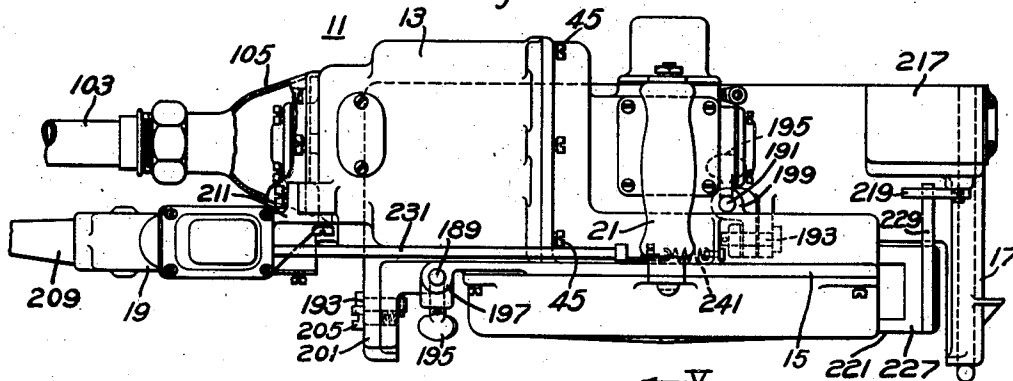


Fig. 2.

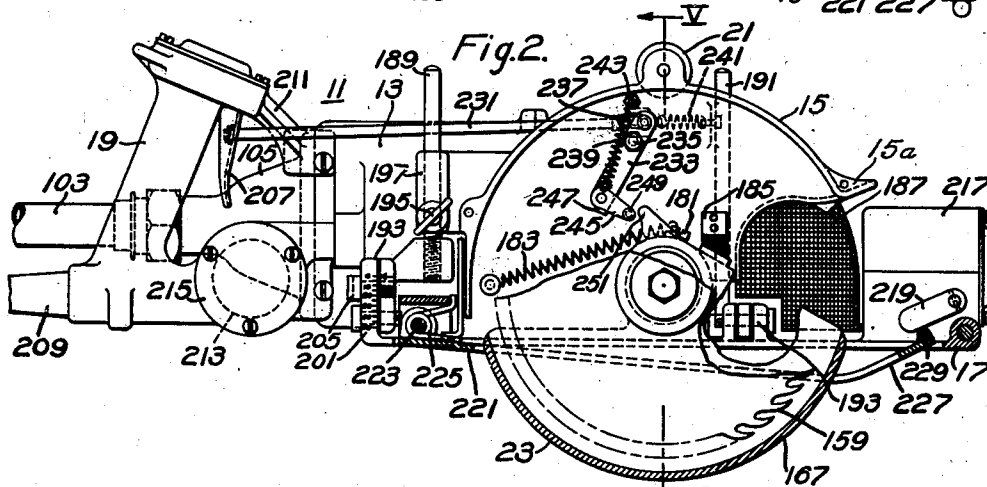


Fig. 3.

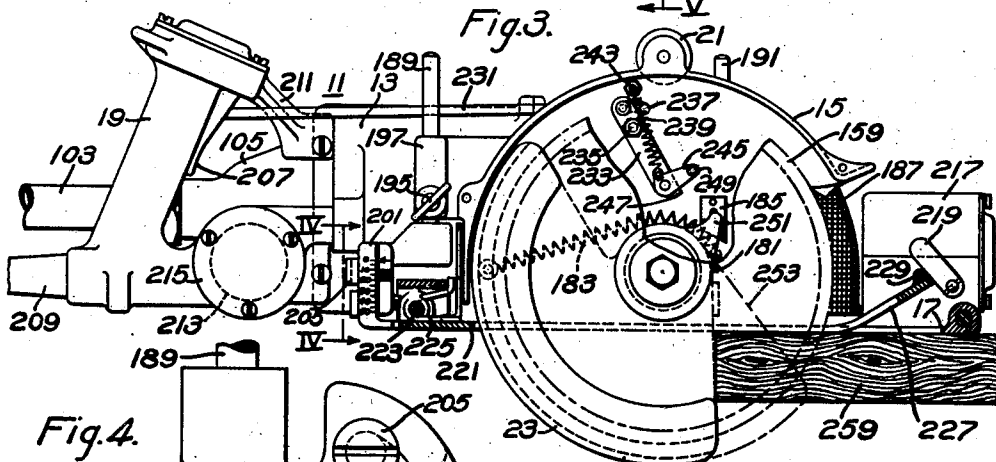
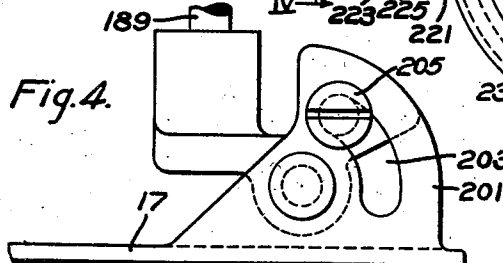


Fig. 4.



INVENTOR
George E. Hampton

March 7, 1933.

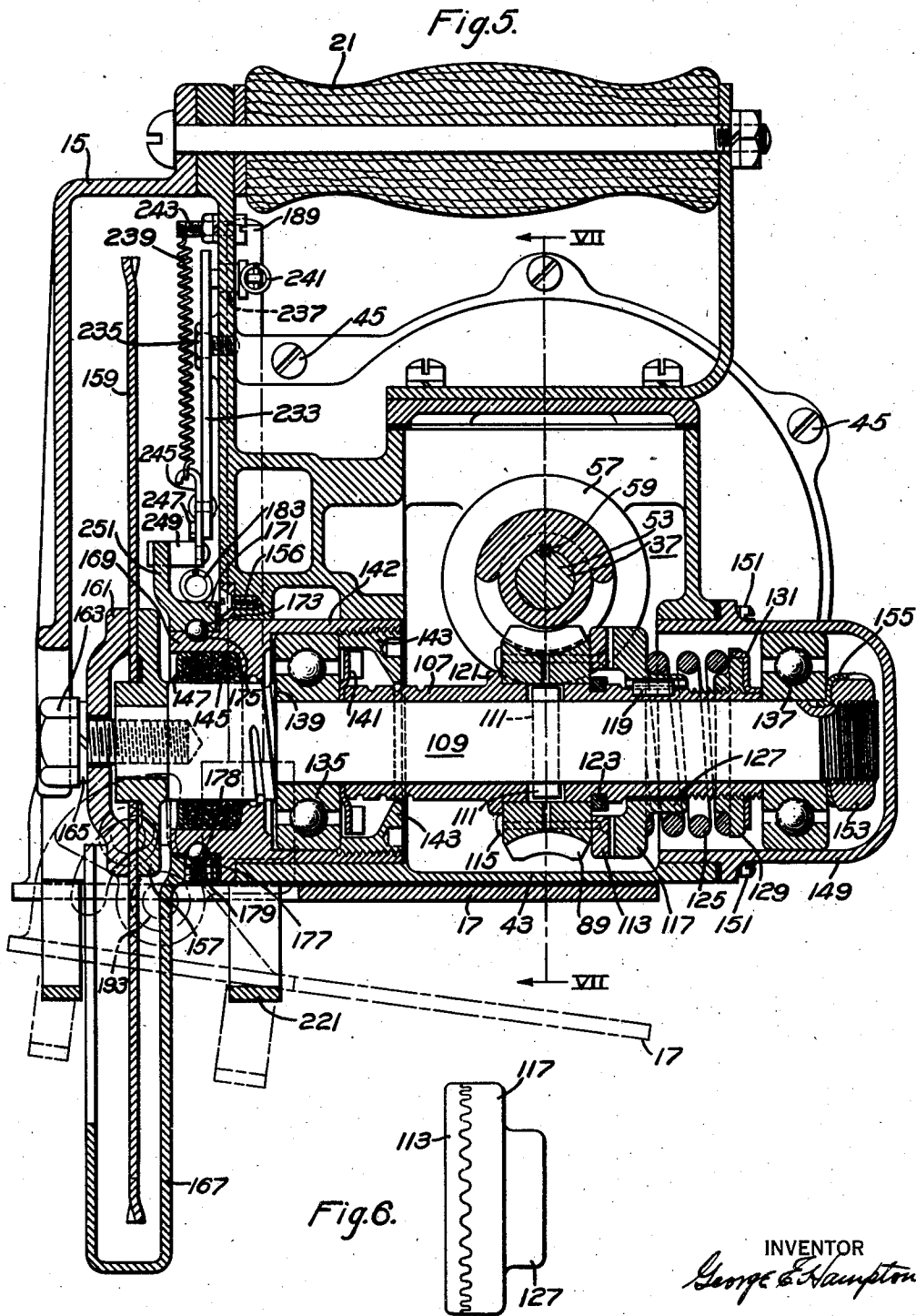
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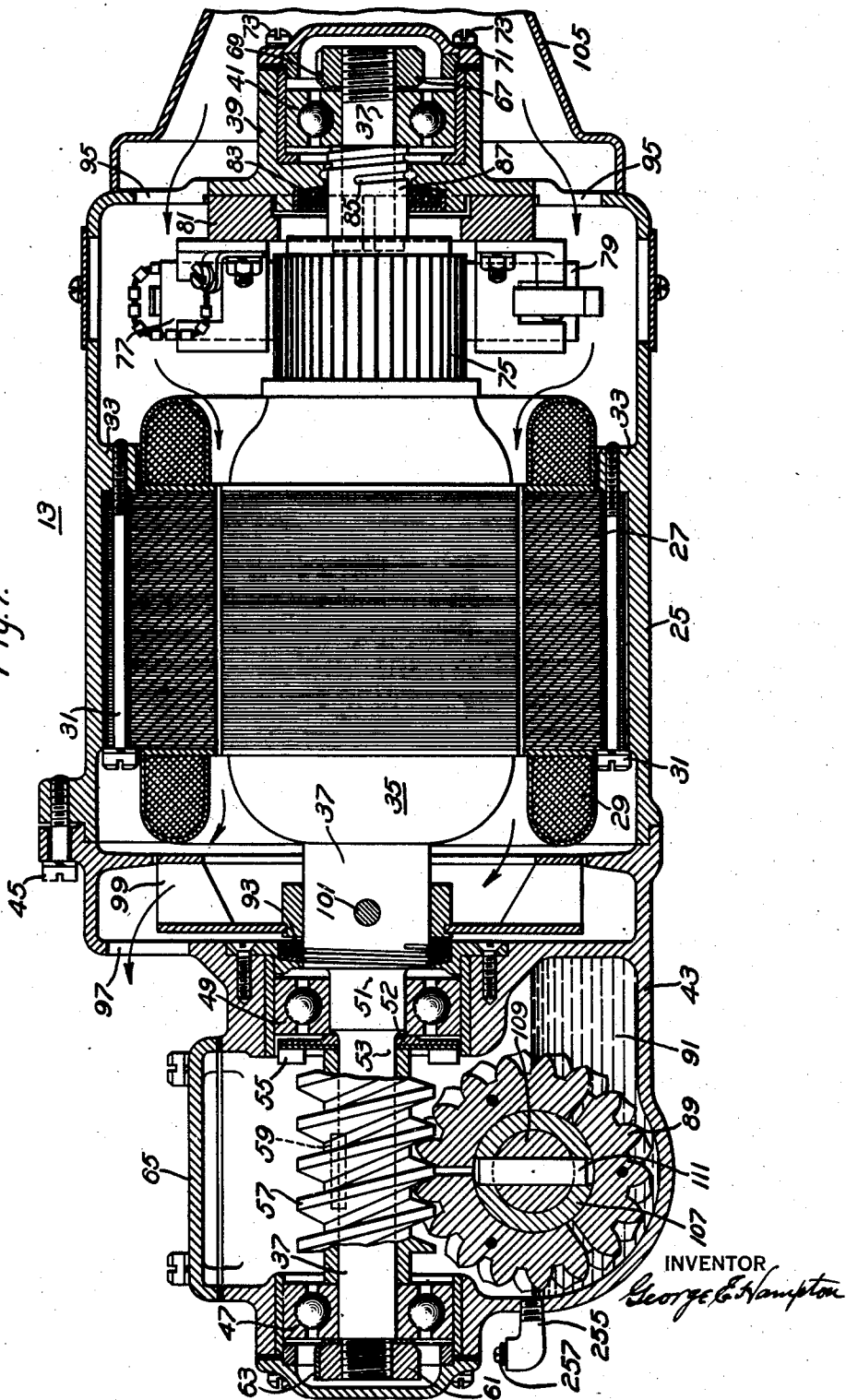
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Fig. 7



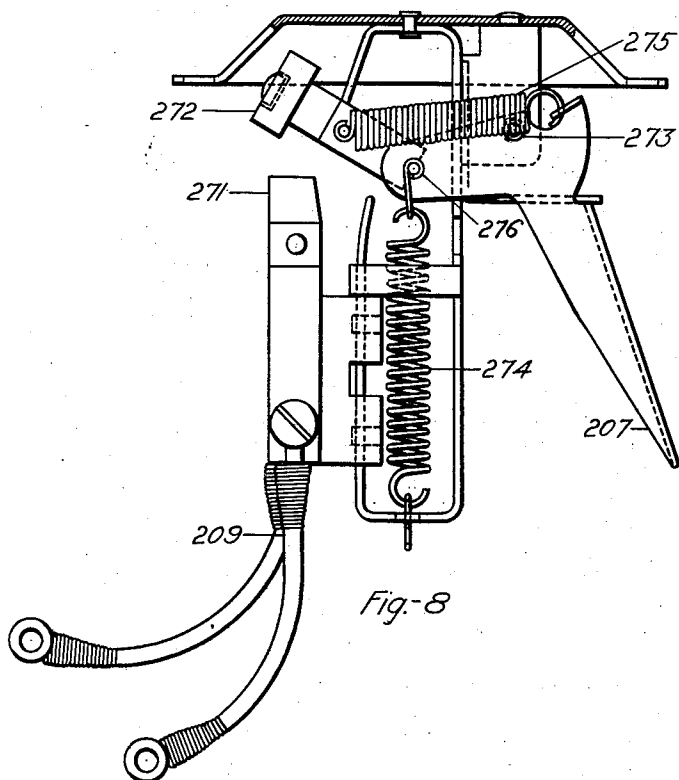
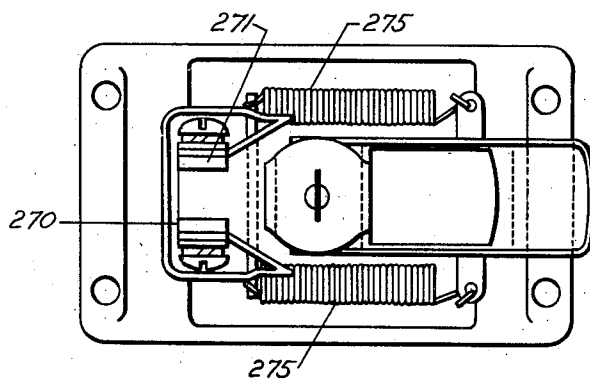
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G. E. HAMPTON
PORTABLE MOTOR DRIVEN SAW

1,900,553

Filed Feb. 4, 1931

4 Sheets-Sheet 4



INVENTOR.
George E. Hampton,
BY *Archworth Martin,*
ATTORNEY.

UNITED STATES PATENT OFFICE

GEORGE E. HAMPTON, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR TO THE SYNTRON COMPANY, A CORPORATION OF DELAWARE

PORTABLE MOTOR DRIVEN SAW

Application filed February 4, 1931. Serial No. 513,268.

My invention relates to motor driven tools and particularly to portable motor driven circular saws.

Among the objects of my invention are the following:—To provide a relatively simple, light, and compact structure for a motor driven circular saw of the portable type, in which the single-piece motor shaft is supported by three ball bearings; to provide a torque-limiting clutch between the motor and the tool, which clutch shall slip with appreciable audible noise in case a predetermined maximum torque is exceeded; to provide a saw arbor or shaft in a housing, the saw shaft being provided with means for preventing the leakage of grease in the housing; to provide a saw-supporting shaft that shall be so mounted as to permit free expansion of one end thereof, while the other end thereof adjacent to the saw is held in a fixed position relatively to the housing; to provide a housing for the saw shaft with means for limiting the amount of oil or grease which may be placed therein; to provide a relatively simple and highly efficient ball bearing support for the movable guard of the saw; to provide means for ensuring a supply of clean air for the motor in case the saw is operating on dusty or dirty work; to provide a freely movable guard for the otherwise exposed portion of the circular saw, that shall be actuable by the operator when grasping a handle of the device; and to provide a plurality of normally open switches and means for closing said switches either by the operator in grasping a handle of the device or by the operator when placing the device in proper operative position on material to be operated on.

Other objects will be apparent in the course of the description of the device, which while describing a specific embodiment of my invention is not intended to be limited thereto, but, particularly in certain of the broader elements may be embodied in other motor driven devices.

In practicing my invention I provide a motor housing having a stator and a rotor structure located therein, the shaft of the rotor being in a single piece and being supported by three spaced ball bearings, with a worm

thereon at one end thereof, and between two of the coaxially aligned ball bearings. Both ends of the motor housing are provided with suitable air inlet and outlet openings and the rear end of the housing is provided with a hood to which may be attached a flexible conduit. The worm on the rotor shaft drives a worm gear mounted on the saw shaft which shaft is mounted in a housing and supported by two ball bearings, one of which is held rigidly in a predetermined position in said housing, while the other end of the shaft is so supported as to be freely expansible axially thereof. The worm gear is loosely mounted on the saw arbor and has secured thereto one member of a jaw clutch, the other portion of which is so mounted on the saw shaft as to rotate therewith but free to move a limited distance axially thereon, the two clutch jaws being spring-pressed into operative engagement. The housing surrounding the saw shaft is provided with an oil plug of such construction as to limit the amount of lubricant which may be placed in the housing. Means is also provided on the saw shaft to counteract the axial flow of lubricant along the saw shaft caused by the operation of the worm and of the worm gear.

The normally upper portion of a circular saw mounted on the saw arbor is protected by a fixed guard or cover, while the lower otherwise exposed portion of the circular saw is covered by a swinging guard, mounted on a portion of the saw structure and concentric therewith, by a form of ball bearing.

The movable guard is moved initially from its normal position by linkage actuated by the operator until it is in such position as to be moved further to its extreme position by material to be operated on. I provide also a relatively simple form of base which may be adjusted for any desired depth of saw cut in such manner that it always remains parallel to its original position. The base may be tilted angularly laterally of the saw structure to permit of sawing material at an angle other than a right angle relatively to a surface thereof.

I provide also a relatively simple and highly efficient safety device for the tool embody-

ing a normally-open motor-circuit-controlling switch located adjacent to or in a handle of the tool, and a second normally-open motor-circuit-controlling switch connected in series circuit with the other switch and actuable to its closed position by an arm which is spring-pressed outwardly from the base in such manner that it effects closing of the second motor-circuit-controlling switch only when the device or tool and material to be operated on thereby are located in positive operating positions relatively to each other.

In the drawings,

Figure 1 is a top plan view of a portable motor driven saw embodying my invention,

Fig. 2 is a view in side elevation thereof with certain portions shown in section,

Fig. 3 is a view in side elevation of a device embodying my invention showing the position of certain parts of the structure when in positive operating conditions,

Fig. 4 is a fragmentary view taken on the line IV—IV of Fig. 3.

Fig. 5 is a view in lateral section, taken on the line V—V of Fig. 2,

Fig. 6 is a fragmentary view in front elevation showing a torque limiting clutch constituting a part of my invention,

Fig. 7 is a view in longitudinal section through a device embodying my invention taken on the line VII—VII of Fig. 5,

Fig. 8 is a sectional view showing the manually-controlled switch contained within the handle 19 of Fig. 2, and

Fig. 9 is an end elevational view of the structure of Fig. 8.

As I have already hereinbefore stated, I have elected to show the application of the various parts or elements embodying my invention as applied to a portable motor driven circular saw, and I wish it to be understood that all of the various elements herein set forth as embodying the present invention, may be applied to other forms of power driven tools in which the driving motor may be an electric motor or some other suitable form of driving device and that they are also applicable to driven tools other than a circular saw and finally that the invention in its broadest aspect is not limited to portable tools but is applicable also to the so called stationary tools, which it may be desired to equip with completely effective safety control devices to safeguard an operator attending the device or tool.

Referring initially to Figs. 1, 2, and 3 of the drawings, I have there illustrated a portable motor-driven circular saw, designated generally by the numeral 11 and including a motor structure 13, a cover 15 for the upper part of the saw, a base or shoe 17, a front handle 19, a second or top handle 21, and a swinging saw guard 23.

Referring now to Fig. 7 of the drawings for further details of the motor structure 13,

it may be noted that there is provided a motor casing 25 which has located therein a stator structure 27, an energizing winding 29, and a plurality of relatively long machine screws 31 to hold the stator assembly in proper operative position against a shoulder portion which may be constituted either by an inner flange 33 or by a plurality of peripherally spaced lugs integral with the casing 25.

A rotor 35 is located within the motor structure 13 and is mounted on a rotor shaft 37 which is made of a single piece of suitable steel, that portion thereof supporting the rotor proper being of larger diameter than the other portions thereof.

At the rear end portion thereof the casing 25 is shaped to constitute a bearing bracket or support 39 in which there is located a ball bearing 41 of usual construction. At the other end of casing 25 I have provided a saw arbor housing 43, one end portion of which is of such shape and dimensions as to interfit with the forward portion of casing 25, against which it is held by a plurality of short machine screws 45. The other end of housing 43 is of a reduced diameter, this portion of reduced diameter constituting the greater axially-extending portion, as may be seen clearly in Fig. 7 of the drawings.

Two spaced ball bearings 47 and 49 are supported by the reduced portion of housing 43, the outer ball races thereof being held in proper operative positions in any suitable or desired manner. The inner ball race of ball bearing 49 is initially loosely located on a portion 51 of shaft 37 and held thereon in a manner to be later set forth. A washer or spacer 52 is then located against the outer face of the inner ball race and on a portion 53 of shaft 37 of reduced diameter. A paddle wheel or fan structure 55 is then located on the reduced portion 53 of shaft 37 having one face abutting against one face of the spacer 52. A worm 57 is pressed on the shaft portion 37 and may be held thereon by a suitable key 59. The inner ball race of bearing 47 is then located on the shaft 37 and a lock nut 61 is screwed on tightly so as to secure the following members in their proper operative positions: the inner ball race of bearing 47, worm 57, paddle wheel 55, washer or spacer 52 against the shoulder of the shaft and the inner ball race of bearing 49. A suitable lock washer 63 holds the nut 61 in finally adjusted position. The housing 43 may be provided with an opening in the upper or top portion thereof and a cover 65 of dish shape may be provided to normally close this inspection opening.

Referring further to Fig. 7 of the drawings, I have illustrated a nut 67 having screw threaded engagement with the other end of shaft 37, a lock washer 69 being provided to prevent turning of the nut on the shaft. A

cover member 71 is provided for the open end of bearing bracket 39 and is held in proper operative position thereagainst by a plurality of machine screws 73.

5 I have illustrated a universal type of rotor embodying a commutator 75 and a plurality of brushes 77 and 79 in suitable holders which may be supported by a brush holder yoke 81.

10 In order to prevent lubricant from escaping from the bearing 41 along the shaft 37 and toward the commutator 75, I provide a suitable packing 83 around the shaft, together with an oil thrower groove 85 on a bushing 87 located around a portion of the commutator
15 end of shaft 37.

The co-operating action of worm 57 and worm gear 89 driven thereby will cause lubricant such as a heavy oil 91 in housing 43 to flow in a predetermined direction, and in the
20 case of the structure herein shown the tendency will be for the lubricant to be forced along worm 57 toward the rotor 35 and the paddle wheel 55 is provided to counteract this flow of lubricant toward the bearing 49 in
25 order to ensure that the duty to which a packing 93 around shaft portion 37 is subjected will not be too severe.

A plurality of openings 95 are provided at the rear end of the motor housing and one
30 or more openings 97 are provided at the forward end of the housing so that a fan 99 mounted on shaft portion 37 and held by a pin 101 will be able to draw air into and force it out of the interior of the motor housing.
35 As it may happen that a circular saw must operate on dusty or dirty work it is desirable that clean air be provided to be operated on by fan 99 and I provide a flexible conduit 103 (see Fig. 1) which is removably screwed on to
40 an extension 105 of bell-shape, the enlarged end of which is suitably secured against the end of the motor structure 13, as is shown more particularly in Fig. 7 of the drawings.

Referring now to Fig. 5, the worm gear 89
45 is loosely mounted on a sleeve 107 which in turn is mounted on a saw shaft 109, being secured thereon by a through pin 111, or by other suitable means. One portion 113 of a jaw clutch coupling is secured against one
50 side of the worm gear 89 and is held thereagainst by rivets 115. The second portion 117 of the coupling is mounted on a portion of the sleeve 107 in such manner as to be axially movable thereon but prevented from
55 turning relatively thereto by a key 119. It may be noted also that worm gear 89 fits against a shoulder 121 on sleeve 107 and is held against this shoulder by a spring ring 123 which fits into the sleeve 107. A helical
60 spring 125 surrounds a reduced portion 127 of coupling portion 117, the other end of spring 125 fitting against an internally screw-threaded collar 129 which may be adjusted on a portion of sleeve 107 and be held in any
65 adjusted position by a lock washer 131. The

co-operating faces of the two portions 113 and 117 are of substantially the shape shown in Fig. 6 of the drawings, that is, the co-operating faces are serrated, the corners or
70 angles being rounded so that with a given spring tension the clutch will transmit up to a certain load, after which it will slip.

The saw shaft 109 is rotatably supported in housing 43, which extends at right angles to the motor housing, by two ball bearings
75 135 and 137. Ball bearing 135 is held in proper operative position against a shoulder 139 of shaft 109 by the slipped-on sleeve 107, a paddle wheel 141 being located therebetween as shown more particularly in Fig. 5
80 of the drawings. The outer ball race of bearing 135 is held in its proper operative position within a cage 142 by a bearing nut 143 which has external screw threads interfitting with internal screw threads in a portion
85 of cage 142. In this manner ball bearing 135 is held rigidly in a fixed position on shaft 109 and also in a fixed position in cage 142. A plurality of packing rings 145 are located around the outer or saw end of shaft 109 and
90 are held by a suitable metal gasket 147 in order to prevent the outflow of lubricant from cage 142 past the bearing 135.

The outer end of gear housing 43 is open and is covered by a cap member 149 which
95 is coaxial with shaft 109 and which is held in proper operative position by a plurality of short machine screws 151. The inner ball race of bearing 137 is held in fixed position
100 on shaft 109 by a nut 153 having screw threaded engagement with a portion of shaft 109, the nut 153 being prevented from turning by a lock washer 155.

It may be noted here that the above described construction of the saw shaft or
105 arbor and the parts thereon constitute an assembly that may be built up as a unit and then placed in position within the housing surrounding it. Thus the ball bearing 135 may be located, as described, against the
110 shoulder 139 and in the cage 142, the outer ball race being held by nut 143. Then the paddle wheel 141, the sleeve 107 with the worm gear 89, the jaw clutch coupling, the compression spring 125, the collar 129 and
115 the lock washer 131 thereon, and the ball bearing 137 may be placed in sequence on the shaft 109 and all held in proper axial positions thereon by nut 153.

The cage 142 may then be inserted in an
120 opening in housing 43 from the right hand side as seen in Fig. 5 and be held therein by a plurality of screws 156. The inner surface of cap member 149 is made smooth so that
125 the bearing may move therein axially thereof in case of expansion of shaft 109 because of rise of temperature thereof after the device has been in operation or some time, that is, longitudinal expansion of the shaft
130 109 is permitted.

The other end of shaft 109 is provided with a flange abutment 157 and a circular saw 159 is clamped thereagainst by a circular resilient clamping member 161 which, in turn, is held by a cap screw 163 and a lock washer 165.

The housing 43 of the gears has associated therewith, as has already been hereinbefore mentioned, a cover 15 for the upper and larger portion of the circular saw 159. A swinging guard 167 is pivotally mounted for turning movement on an extended portion 169 of cage 142 (see Fig. 5), a hub portion 171 of the swinging guard 167 being provided with an inner substantially semi-circular groove 173 to co-operate with a similar groove 175 in portion 169 whereby an annular groove of substantially circular shape in lateral section is provided. Hub portion 171 is provided with a radial opening 177 to permit of introducing into the groove of circular shape a plurality of steel balls of the proper size, the number placed therein being just sufficient to fill the annular groove to thereby provide a ball bearing for the swinging guard on the extension 169. When the proper number of steel balls have been placed in the groove a screw threaded plug 179 is fitted into the opening 177 to close the same. Guard 167 is provided with a lug 181 in substantially the position shown in Fig. 2 of the drawings and a tension spring 183 is connected to a part of cover 15 and to lug 181 to hold the guard in its normal inoperative position, substantially as shown in Fig. 2 of the drawings, where a portion thereof abuts against a stop lug 185 secured against a part of cover 15.

It may be noted that the lower right hand portion of cover 15 is cut away (see Fig. 2) and a suitable metal screen 187 covers the otherwise open portion to properly protect the saw. A lip-like shield 15a projects from the forward edge of the cover 15 to a point forwardly of the screen 187 so that saw-dust which is blown through the screen by movement of the saw during cutting will be deflected in a generally horizontal direction, but slightly upwardly, instead of being blown vertically upward where it will obscure the vision of the operator.

The shoe 17 is adjustably supported relatively to housing 43 by being provided with a pair of spaced upstanding rods 189 and 191 to which the base is pivotally connected as by means of a hinge structure co-operating with each upstanding rod, such a hinge structure being shown at 193 in Figs. 1 and 2 of the drawings. Thumb nuts 195 are provided to clamp rods 189 and 191 in apertured portions 197 and 199 made integral with the gear housing 43.

Means for adjusting the shoe 17 angularly relatively to the saw, assuming that it has been moved away from the housing to a certain amount, may include the hereinbefore

mentioned hinge structures 193 and a suitable locking means, one form of which is shown in Fig. 4 in end elevation, and in side elevation in Figs. 2 and 3. An arcuate portion 201 having an arcuate slot 203 therein (see Fig. 4) has extending therethrough a machine screw 205 fitting into an adjustable portion of shoe 17. A scale and a mark as shown in Figs. 2 and 3 may be provided on the arcuate surfaces of the fixed member 201 and the movable shoe and be properly graduated in mechanical degrees to indicate the angle of tilt of the shoe. I do not desire, however, to be limited to the precise structure shown, as I may employ equivalent clamping means.

The handle portion 19 hereinbefore mentioned has located therein a normally-open motor circuit controlling switch of any desired or suitable kind, the handle 207 thereof being located outside of and closely adjacent to the handle 19. A current conducting cable 209 may extend into a part of the handle 19, and be of any suitable or desired length and provided at its other end with a suitable plug to permit of energizing the motor in a manner well known in the art. The switch within the handle 19 is shown more clearly in Figs. 8 and 9 and has two stationary contact members 270 and 271 that are respectively connected to the current conductors of the cable 209. A movable contact member 272 cooperates with the stationary contact members to control the motor circuit. The contact member 272 is pivotally mounted in the handle 19 and has toggle connection with the switch lever 207 that is pivotally mounted in the casing at the point 273. A spring 274 anchored at its one end to the switch casing, and at its other end to the toggle joint serves to yieldably maintain the switch in open position as shown in Fig. 8.

When the lever 207 is moved toward the handle 19, the toggle joint 276 is carried between tension springs 275 whose ends are connected to the lever 207 and the movable contact member 272, so that the springs 275 instead of tending to retain the movable contact member in open position will snap it to closed position between the stationary contact members 270 and 271. When the switch lever 207 is released by the operator, the spring 274 will overcome the tension of the springs 275 and return the switch mechanism to the position shown in Fig. 8. The upper end of handle 19 is secured through a bracket 211 to the motor housing 13 and the lower portion thereof may be provided with a substantially circular opening 213 with a cover member 215 thereon in order that a thermally-actuable circuit-controlling switch may be located therein if desired.

A second normally-open motor-circuit-controlling switch is located in a casing 217 at the forward end of the tool and is provided

with an actuating arm 219 located outside of the housing 217. Means for effecting the closing of this switch is located in and may be said to constitute a part of the shoe 17 and is shown as including a relatively long bar 221 pivotally mounted at the rear thereof on a pin 223, a spring 225 being provided to yieldingly hold the member 221 in the position shown in Fig. 2 of the drawings where it is resiliently forced out of the plane of the shoe. The forward portion 227 of member 221 is bent upwardly and has a rod 229 secured thereto as by welding, the inner end of rod 229 being so located as to engage arm 219 to actuate the switch of which arm 219 is a part.

Means for effecting initial movement of the swinging guard 167 by an operator includes a link 231 pivotally connected at one end to the switch handle 207 and having its other end pivotally connected through a lost-motion slot connection with a swinging arm 233, which is pivotally mounted intermediate its ends inside of cover 15 (see Fig. 5), by a pivot pin 235 moving in an arcuate slot 237. The arm 233 is held in either of its limiting positions by an overcenter spring 239, the link 231 being yieldingly urged to one limiting position shown in Fig. 2, by a spring 241. The upper end of spring 239 is secured to a pin 243 in housing 15 and its lower end is secured to a dog 245 pivotally mounted on the lower end of arm 233, a lug 247 being provided on arm 233 to limit the turning movement of dog 245 in one direction.

The various parts of the device are shown in their normal or inoperative positions in Fig. 2 of the drawings. The handle 207 of the first motor-controlling switch is in such position that the switch controlled thereby is open. The same is true as regards the switch controlled by handle 219. If now an operator desires to use the circular saw on a piece of material 259, (see Fig. 3) he will first pick up the portable saw assembly by handle 19 and, assuming that he thereby carries it to the place of operation, he will then grasp handle 21 with the other hand to properly hold and locate the saw assembly with relation to the piece of work or material to be operated on. It may here be pointed out that the swinging pivotally-mounted guard 167 is resiliently held in substantially the position shown in Fig. 2 of the drawings where its forward tip or end portion would effectively prevent its being turned on its bearing by a piece of wood to be sawed.

It is therefore necessary for the operator to place his fingers around handle 207 and to firmly close them in order to move the handle 207 against the tension of spring 241 and against the pressure of a spring associated with the switch which biases the first motor-circuit-controlling switch to its open posi-

tion. The turning movement of handle 207 towards handle 19 has two results: first, the switch controlled by handle 207 is closed, and second, a projection 249 on dog 245 engages a projection 251 of the swinging guard and causes it to turn on its pivot bearing and move into a position indicated by the broken lines 253 in Fig. 3 of the drawings. It may be noted that the projection 249 on dog 245 extends laterally thereof in order that it may properly engage the projection 251, the relative positions of these members in one plane being shown in the left hand portion of Fig. 5 of the drawings.

If now the operator presses positively downwardly on handle 21 so that the forward portion 227 of member 221 engages a piece of wood 259, the pivotally mounted arm 221 will have its forward end moved upwardly, and upon the operator's exerting sufficient pressure on the handle 21, it will be moved into substantially the position shown in Fig. 3 of the drawings, as a result of which upward movement arm 219 is moved from the position shown in Fig. 2 of the drawings to the position shown in Fig. 3 of the drawings to effect closure of the second motor-circuit-controlling switch. It is to be understood of course that the circular saw 159 will not be caused to rotate until both motor-circuit-controlling switches have been moved to their closed positions, the first switch in handle 19 being closed by the grip of one of the hands of the operator, and the second motor-circuit-controlling switch being closed by positive operating engagement between the saw structure, and more particularly the shoe thereof, and material to be operated on.

It is of course necessary for the operator to prevent engagement of the saw teeth with the material before the saw blade is being rotated, but as soon as both motor-circuit-controlling switches have been closed as set forth above, the saw will be rotated and forward movement of the device may be effected at a rate of speed as determined by the operator in accordance with the several factors affecting the speed of movement, in a manner well known in the art. As soon as the guard 167, moved into the position shown by the broken lines 253, is engaged by the material 259, it will be turned on its bearing until it has been moved entirely out of the way of the piece of material, that is, into the cover 15. It is obvious that it is necessary for the operator, in a device of the kind herein disclosed, to so hold the device that there will be a positive operating engagement and sufficient pressure between member 221 and material 259 being sawed to ensure that member 221 is maintained in the position shown in Fig. 3 of the drawings. For if this is not the case, the switch controlled by arm 219 will automatically be opened by reason of spring 225 causing the return of arm 221

to the position shown in Fig. 2, with a consequent opening of the switch controlled by arm 219.

Upon a piece of wood having been completely sawed through the swinging guard 167 will move back into the position shown in Fig. 2 of the drawings, and if this movement is effected before the operator releases his grip on handles 19 and 207, the projection 251 will have moved back into the position shown in Fig. 2 of the drawings, while dog 245 is still in the position shown in Fig. 3 of the drawings. The dog 245 is pivotally mounted on link 233 so that it may operate as a pawl and move over the end of projection 251 when the operator releases his grasp on handle 207.

I desire here to point out more particularly the efficacy of the second motor-circuit-controlling switch and its actuation by member 221. If the second switch were not provided and if the operator were to firmly grasp handles 19 and 207 he would close the motor circuit, while at the same time the swinging guard would be moved to such position as would expose a part of the circular saw so that serious injury to the operator might result. If however, the second motor-circuit-controlling switch is provided, the motor will not be energized even if the operator should grasp handles 19 and 207 tightly enough to close the first switch. I have pointed out particularly the operation and effect of the second switch as it is obvious that the second switch and its actuating member controlled by the direct positive contact thereof with material to be operated on when the material is placed in proper position relatively to the tool to be operated on thereby, can be applied to many other motor driven devices which are designed and built to operate on various kinds of material. It is only necessary to locate the pivotally mounted arm actuating the second switch, in such manner that material to be operated on will engage the same when placed in proper position to be operated on and, as noted above, I believe that this is applicable to many other forms of motor driven devices.

Housing 43 may be filled to a certain height with a lubricant such as heavy oil 91 (see Fig. 7) and in order that it shall be impossible to permanently fill housing 43 with an excessive amount of oil, I provide an oil filling plug 255 as shown at the left hand end of Fig. 7. A removable closure 257 is provided for the plug and this must be removed in order to pour oil into the housing 43 and if the tool is resting upon a horizontal surface it is obvious that the amount of oil which will remain in housing 43 is limited to substantially the top of oil plug 255.

Rotor shaft 37 is made in one piece and its inherent frequency of vibration, as a column, is relatively low but it may happen that the speed of rotation is so high that

lateral vibration thereof will occur. In order to overcome or counteract this vibration I provide the three coaxially aligned ball bearings shown more particularly in Fig. 7 of the drawings, two of these ball bearings being located relatively close together and one on each side of the worm 57. I have found, as the result of actual tests, that a motor rotor thus supported will operate at speeds on the order of 10,000 R. P. M. without noticeable vibration and I attribute this entirely to the use of three coaxially aligned ball bearings supporting a single piece shaft.

Referring to Fig. 7 of the drawings, it may be noted that a paddle wheel 55 is located on the portion 53 of shaft 37 in order to counteract the tendency of lubricant being forced toward the right by worm 57 when the same is rotated. If the paddle wheel 55 were not provided lubricant would be forced against and through ball bearing 49 and the packing 93 would be subjected to excessive oil pressures and might give way, thereby permitting oil to reach the motor windings. Substantially the same comments hold in regard to the saw shaft and the paddle wheel 141 shown more particularly in Fig. 5 of the drawings.

The provision of a torque limiting device, shown in Fig. 6 of the drawings, ensures that the motor shall not be overloaded. In a portable tool of this kind there is always a tendency on the part of an operator to force the tool in order to make speed, and if this is continued for too long a time or to too great an extent, it will inevitably result in a burn-out of the motor. The device embodying my invention provides a torque-transmitting device which is adjustable and which, when it slips as by being subjected to an excessive load, will give an audible and unmistakable signal to the operator.

The provision of means cooperating with the saw shaft to permit expansion thereof axially in case of temperature rise, ensures that it will not bind the bearings, and coupled therewith is the provision that the bearing located adjacent to the saw itself is held rigidly to prevent end play of the saw and of the shaft.

The swinging guard is provided with a relatively simple and effective bearing, which not only permits the swinging movement of the guard, but also ensures that the guard will be held in its proper operative position axially of its support.

It may be noted also that it is relatively easy to adjust the shoe to effect any desired depth of cut of the saw by the loosening of the thumb nuts 195, the moving of the shoe, which it may be noted, moves parallel to itself, and then a retightening of the thumb nuts.

It is also easy to tilt the shoe by loosening one screw and then tilting the shoe to the desired angle after which the tightening screw 205 may again be tightened.

While I have illustrated and described a specific embodiment of my invention, it is obvious that many of its objects and elements are not limited to the particular device shown in the present application, and I desire, therefore, that the scope of the appended claims shall be limited only by the pertinent prior art.

I claim as my invention:—

1. In a portable motor driven tool assembly including a handle for the assembly and a driving motor, a motor-circuit-controlling switch located adjacent to the handle to be grasped by the operator in holding and guiding the tool by said handle, a second motor-circuit-controlling switch in series circuit with said first switch, and means for closing said second switch upon pressing said tool and material to be operated on thereby into close operating engagement.

2. In a portable motor driven tool assembly including a handle and a motor, a normally open motor-circuit-controlling switch adjacent to the handle to be closed by the operator in holding and guiding the tool by said handle, a second normally open motor-circuit-controlling switch in series circuit with said first switch, and means closing said second switch when the tool is pressed positively and firmly into operating engagement with material to be operated on by said tool.

3. In a portable power driven tool assembly including a driving member therefor, a cutting tool, a fixed housing for a portion of the tool, a movable guard for another portion of the said tool, a device actuatable to initiate movement of said movable guard toward a position where the tool will be exposed, and means preventing a complete swinging movement of the guard by said device, swinging movement of the movable guard being completed by relative operating movement between the cutting tool and the material being operated on thereby.

4. In a portable power driven tool assembly including a driving member therefor, a cutting tool, a fixed housing for a portion of the tool, a movable guard for another portion of the said tool, a device actuatable to initiate movement of said movable guard toward a position where the tool will be exposed, means preventing a complete swinging movement of the guard by said device, swinging movement of the movable guard being completed by relative operating movement between the cutting tool and the material being operated on thereby, and a power control device actuated in predetermined relation to movement of the guard.

5. A portable cutting apparatus comprising a unitary assembly including a driving element, a rotatable cutter driven thereby, a swinging guard pivotally mounted coaxially of the cutter, means normally maintaining the guard in advance position to shield a given

portion of the cutter, and means whereby it is possible to swing said guard only such distance as to expose but a part of the cutter, swinging movement of the guard being completed by engagement thereof with the material being operated on by the cutter.

6. A portable cutting apparatus comprising a unitary assembly including a driving member, a cutting element driven thereby, a movable guard covering a portion of the said element when in its normally closed position, means actuatable in one direction to swing said guard only such distance as to expose a part of said portion of the cutting element, means for supporting the guard so that swinging movement thereof will be completed by engagement with the material being cut by the said element, and means causing the guard to return to its normal guarding position when the cutting element has been removed from the material, independently of movement of the said actuatable means in the opposite direction.

7. Portable cutting apparatus comprising a unitary assembly including a driving member, a cutting element driven thereby, movable guard for said element, means normally maintaining the guard in advanced position to shield a given portion of the cutting element, and a device for controlling the driving element and having connection with the guard to effect movement thereof in opposition to said means when the said device is operated to set the cutting element in operation, the said guard being positioned for engagement with the material operated upon by the cutting element and thereby moved further toward retracted position and in disconnected relation to the said device.

8. Portable saw apparatus comprising a unitary assembly including a motor, a saw blade driven thereby, a movable guard for the blade, means normally maintaining the guard in advanced position to shield a given portion of the blade, a manually operable device for controlling the motor and having connection with the guard to effect movement thereof in opposition to said means when the said device is operated to set the motor in operation, the said guard being positioned for engagement with the material operated upon by the saw and thereby held in retracted position and in disconnected relation to the said device, and means for restoring the said device and the guard to cooperative relation after the guard has passed out of engagement with the material and the said device moved to effect stopping of the motor.

9. Portable saw apparatus comprising a unitary assembly including a motor, a saw blade driven thereby, a movable guard for the blade, means normally maintaining the guard in advanced position to shield a given portion of the blade, a manually operable de-

vice for controlling the motor and having connection with the guard to effect movement thereof in opposition to said means when the said device is operated to set the motor in operation, the said guard being positioned for engagement with the material operated upon by the saw and thereby held in retracted position and in disconnected relation to the said device, and means for restoring the said device and the guard to cooperative relation after the guard has passed out of engagement with the material.

10. Portable cutting apparatus comprising a unitary assembly including a driving member, a cutting element driven thereby, a movable guard for said element, means normally maintaining the guard in advanced position to shield a given portion of the cutting element, and means operable to move said guard toward retracted position and disconnectible therefrom upon engagement of the apparatus with the work, to permit return movement of the guard to advanced position independently of further movement of the said operable means.

11. A portable motor driven saw assembly comprising a driving member, a rotatable cutting element, a cover for the upper and rear portions of the cutting element, a screen constituting a continuation of the cover and positioned to shield a forward portion of the said element, a movable guard normally enclosing the lower portion of the cutting element and having its upper edges extending into the said cover and screen, mechanism in the cover for moving the said guard rearwardly into the cover, and means for operating said mechanism.

12. A portable motor driven saw assembly comprising a driving member, a rotatable cutting element, an imperforate cover for upper and rear portions of the cutting element, a screen constituting a continuation of the cover and positioned to shield a forward portion of the said element, a guard positioned to shield the lower portion of the said element, and a deflector extending forwardly from the front edge of said cover.

13. A portable motor driven saw assembly comprising a driving member, a rotatable cutting element, an imperforate cover for upper and rear portions of the cutting element, a screen constituting a continuation of the cover and positioned to shield a forward portion of the said element, a guard positioned to shield the lower portion of the said element, and a deflector extending from the front edge of said cover in a forwardly and upwardly inclined direction from the line of juncture between the cover and the screen.

14. Portable cutting apparatus comprising a unitary assembly including a driving member, a cutting element driven thereby, a movable guard for said element, means normally

maintaining the guard in advanced position to shield a given portion of the cutting element and in advance of the part of said element which must engage the work, so that it may not engage the work until the guard is shifted, and means actuable to move said guard toward retracted position where at least a part of the cutting element will be exposed, and into a position that it may engage the work so that the guard may be forced back by the work as the tool advances, said means providing a clear path for return movement of the guard to its advanced position when the cutting element has been removed from the material.

In testimony whereof, I have hereunto subscribed my name this 22nd day of January, 1931.

GEORGE E. HAMPTON.