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SAFETY DEVICE

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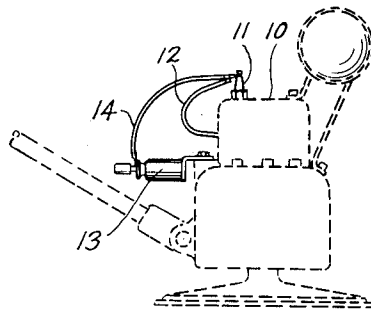


Fig.-1

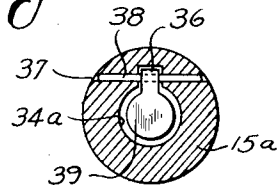


Fig.-6

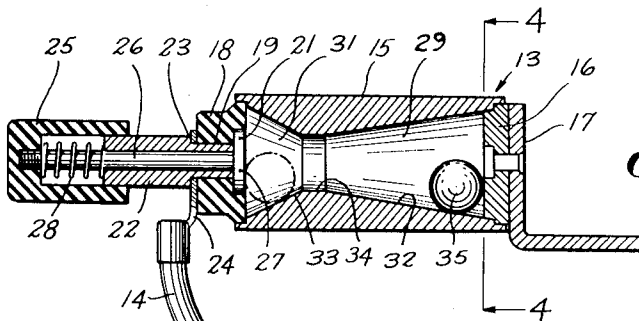


Fig.-2

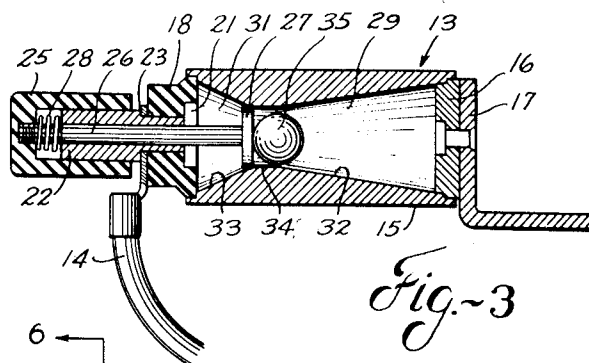


Fig.-3

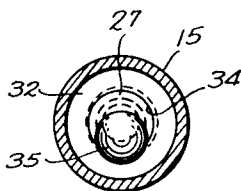


Fig.-4

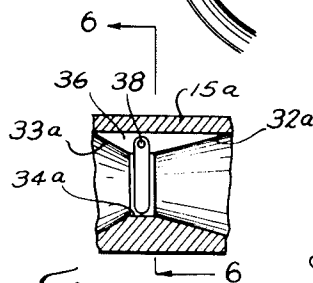


Fig.-5

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SAFETY DEVICE

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This invention relates to hand operated gasoline engine powered tools, and more particularly to a safety device for automatically discontinuing operation of the engine when the operator loses control of the tool.

In tools of the class described, such as a mechanical trowel, the engine has what might be described as a floating mounting between the tool or implement which engages the work and the handle held by the operator. The engine normally drives the implement, but if the handle is not securely held and if the resistance of the work is sufficient, the engine will revolve while the implement remains stationary. The result is that the tool gyrates uncontrollably at the risk of damage to itself and injury to the operator and other nearby workers. To recover control of such a runaway tool is, moreover, additionally hazardous.

The object of the invention is to simplify the construction as well as the means and mode of operation of a safety device as disclosed herein, whereby such devices may not only be economically manufactured, but will be more efficient and accurate in use, adaptable to a wide variety of tools, having relatively few parts and be unlikely to get out of repair.

A further object of the present invention is to limit the duration of if not substantially to prevent such gyrations through supplemental engine control means operating as a result of and in response to uncontrolled turning movement of the engine.

Another object of the invention is to discontinue automatically the operation of the engine in a tool of the class described when the operator loses control thereof and to prevent resumption of operation until a manually initiated reset action is taken.

A further object of the invention is to obtain such automatic control by incorporating in the ignition system a short circuit to ground, closed in response to the uncontrolled turning of the engine.

Still another object of the invention is to utilize a principle of centrifugal force in the closing of the short circuit.

A still further object of the invention is to present an automatic safety device of the class described characterized by a simple, inexpensive construction and by a facile adaptation to installation on existing tools.

Still another object of the invention is to adapt the safety device of the invention for use as a deenergizing on-off switch.

A still further object of the invention is to present means for precluding misoperation of the safety device under abnormal working conditions.

A further object of the invention is to provide a machine possessing the advantageous structural features, the inherent meritorious characteristics and the mode of operation herein mentioned.

With the above primary and other incidental objects in view as will more fully appear in the specification, the invention intended to be protected by Letters Patent consists of the features of construction, the parts and com-

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binations thereof, and the mode of operation, as hereinafter described or illustrated in the accompanying drawings, or their equivalents.

Referring to the accompanying drawing, wherein is found the preferred but obviously not necessarily the only form of embodiment of the invention,

Fig. 1 is an installation view, showing a fragment of the engine as equipped with a safety device in accordance with the instant invention;

Fig. 2 is a detail view, in longitudinal section, of the automatic safety device, showing the parts in normal position with the short circuit open;

Fig. 3 is a view similar to Fig. 2, showing the device in the process of being reset;

Fig. 4 is a view in cross section, taken substantially along the line 4—4 of Fig. 2;

Fig. 5 is a fragmentary view in longitudinal section of a modified form of the safety device; and

Fig. 6 is a view in cross section, taken substantially along the line 6—6 of Fig. 5.

Like parts are indicated by similar characters of reference throughout the several views.

Referring to the drawing, an installation view of the safety device of the invention appears in Fig. 1 wherein a fragment of the cylinder head 10 of an engine is shown, the engine being a part of a hand controlled rotary tool powered by a gasoline engine, for example, a mechanical trowel. It will be understood that the tool further comprises a drive shaft, a work performing implement rotated by the shaft, a handle whereby the tool may be guided and manipulated by the operator, and suitable operating controls. In operation, the engine rotates the drive shaft which in turn actuates the work performing implement. Due to the resistance of the work, a force of reaction is set up which is absorbed by the operator, who holds the handle and the engine, to which the handle is connected, relatively immovable while the drive shaft and work performing implement turn. Should the operator release his grip on the handle, however, the application of forces is reversed, the drive shaft and work performing implement now standing still with the engine and handle revolving therearound. It is toward the correction of this situation, with its accompanying hazardous gyrations of the tool, that the instant invention is directed.

As shown in Fig. 1, the engine is energized by an ignition system which includes a spark plug 11 mounted in the cylinder head 10. An electrical conductor 12 supplies current to the spark plug, being connected at its one end to a magneto and at its other end in a conventional manner to the top of the plug. A control switch (not shown) in the system operates in the usual way to open and close the circuit from the magneto to the spark plug and thereby to stop the engine and to condition it for starting. The present invention contemplates what is, in effect, a supplemental switch in the ignition system providing for grounding of the system to stop the engine irrespective of the position of the main control switch.

Such function is carried out by an automatic device 13 which is grounded by mounting on the cylinder head 10 and which is connected in the ignition system by an electrical conductor 14 attached to the spark plug. Referring to Figs. 2 and 3, the device 13 includes a cylindrical body 15 made of an electrical conductive material. One end of the body is closed by a cap 16 to which is fixed a bracket 17, both the cap and bracket being of electrical conductive material the same as the body. The bracket 17, as shown in Fig. 1, is constructed and arranged to be fastened to the cylinder head 10.

The opposite end of the body 15 is closed by a cap 18 made of a material having electrical insulating properties. The cap 18 has a central bore 19 therein, and, in its inner face, a counterbore 21. The bore 19 re-

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ceives the reduced inner end of a bushing 22 made, like the body 15, of an electrical conductive material. The stepped-down end on the bushing 22 defines a shoulder 23 on which is seated a clip 24 attached to and forming a part of the conductor 14. The clip 24 has the reduced end of bushing 22 passed therethrough, and, by reason of its contact therewith is in continuous electrical contact with the bushing 22.

The outer or relatively large end of the bushing 22 has a tubular finger piece 25 slidably mounted thereon and made of a non-conductive insulating material. The outer end of the piece 25 is closed and the inner face of such closed end provides a screw threaded mounting for a plunger 26 having an axial sliding bearing in the bushing 22. The inner end of a plunger 26, or that end opposite the end set in piece 25 extends through and beyond the bushing 22 and has a disc-like head 27 thereon adapted to seat in counterbore 21. The plunger and its head may be of integral construction and both are wholly composed of an electrically conductive material, and, moreover, are in electrical contact with conductor 14 through bushing 22.

Within the finger piece 25, in surrounding relation to the plunger 26 and interposed between the finger piece and bushing 22 is a compression spring 28. The spring exerts opposite axial thrusts upon the finger piece 25 and the bushing 22 whereby to maintain plunger head 27 normally seated in counterbore 21 and to urge the bushing 22 in a direction to clamp the clip 24 between shoulder 23 and the cap 18.

The interior of the body 15 is formed with first and second intercommunicating compartments 29 and 31 defined by oppositely sloping walls 32 and 33 meeting in an opening 34 which is longitudinally offset so as to make compartment 29 of greater length than compartment 31. A freely rolling ball 35, made of an electrically conductive material is contained within the body 15. When at rest within the compartment 31, the ball 35 makes common contact with the cylinder and with the plunger head 27. With the ball so positioned, therefore, a circuit to ground is closed through conductor 14, clip 24, bushing 22, plunger 26, ball 35, body 15 and bracket 17 to cylinder head 10. Further, as so disposed in compartment 31 the ball 35 is in position to be ejected through opening 34 into compartment 29 by plunger 26, this being accomplished by manual inward pressure applied to the plunger through finger piece 25.

In the operation of the automatic safety device, the parts are normally positioned as shown in full lines in Fig. 2, with the ball 35 at rest in compartment 29. As so positioned, the short circuit to ground is open and the operation of the engine is under the control of the main ignition switch. The tool may be guided and moved about according to its usual manner of use without interference from the device 13 since motion of the ball out of compartment 29 is inhibited by the inclined slope 32. Should the operator inadvertently release the handle of the tool, however, without first shutting off the engine, the engine including cylinder head 10 will begin to revolve. In response to such motion components of centrifugal force are felt in the body 15, of sufficient strength to move the ball 35 up the slope 32 and through opening 34 into compartment 31. Within compartment 31, the ball 35 comes to rest in the position of common contact with plunger 26 and body 15 before described and the consequent shunting of the electrical circuit to ground stops the engine. The sloping wall 33 in compartment 31 retains the ball 35 in circuit closing position. When it is desired to resume operation of the tool, the safety device is reset to normal position by manual actuation of plunger 26 to return the ball 35 to chamber 29, as indicated in Fig. 3.

In the installation of the safety device it is mounted on the cylinder head 10 in position to gain the maximum influence of centrifugal force, as, for example, on the

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approximate radial line of the drive shaft. A location adjacent to the spark plug is desirable for convenient and simplified connection of the conductor 14. It will be understood, however, that the conductor 14 need not be connected to the spark plug but may lead directly from the magneto or from some other point in the ignition system. The only requirement is that the conductor 14 and device 13 form a path of low flow resistance which the current will follow in preference to the path of high resistance across the electrodes of the spark plug. In installing the device on existing tools it is necessary simply to remove one of the cylinder head bolts, locate the bracket to receive the bolt and then replace the bolt, tightening the head thereof down upon the bracket. The conductor 14 is merely attached to the post of the spark plug in underlying or overlying relation to the conductor 12.

While the device as described has primarily a safety function, it can be used as a deenergizing or temporary on-off switch. The plunger head 27, it will be noted, has a diameter slightly greater than the diameter of cylinder opening 34. Accordingly, when the plunger is thrust inward, in response to actuation of finger piece 25, head 27 will engage and limit against the sloping wall 33 of the cylinder 15. In response to such contact, an electrical circuit to ground is closed the same as when the plunger head and cylinder are converted through ball 35. Thus, if the operator wishes to do so he can stop operation of the engine by pressing plunger 26 inward. Upon release of the plunger, normal operation of the engine may be resumed as spring 28 returns head 27 from contact with the cylinder 15.

It is conceivable that in a tool subjected to very rough handling, or in one acting on an irregular work surface giving an equivalent effect, the disturbance imparted to ball 35 could result in a misoperation of the safety device. That is, the ball 35 might inadvertently be bounced through the opening 34 and ground the ignition system.

As a guard against misoperation of this kind, a modification of the basic conception is contemplated, as shown in Figs. 5 and 6. In this modified form of the invention a cylinder 15a presents an opening 34a and oppositely sloping walls 32a and 33a corresponding to similar parts of the cylinder 15 as previously described. In the cylinder 15a, however, sloping walls 32a and 33a have a key slot 36 cut therein intersecting opening 34a.

Further, the cylinder 15a is formed with a transverse, small diameter bore 37 overlying opening 34a and intersecting key slot 36. The bore 37 has mounted therein a pin 38 and there is suspended from the pin 38 a gate or flapper 39. The gate 39 comprises an ear-like portion received in opening 34a. Accordingly, the gate or flapper 39 is mounted for fore and aft swinging motion in the opening 34a. It imposes no substantial resistance to movement of the ball 35 through opening 34a, but does have an inertia which will not yield to a bouncing, irregular movement of the ball. The impetus of the ball will usually be spent by the time it reaches the gate.

Under a steadily maintained axial thrust, as induced by centrifugal force, the ball has no difficulty in passing by gate 39. The operation of the device of Figs. 5 and 6 is, therefore, the same as that of the device of Figs. 1 to 4, except that provision is made to preclude misoperation under abnormal working conditions.

From the above description it will be apparent that there is thus provided a device of the character described possessing the particular features of advantage before enumerated as desirable, but which obviously is susceptible of modification in its form, proportions, detail, construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

While in order to comply with the statute the invention has been described in language more or less specific as to structural features, it is to be understood that the inven-

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tion is not limited to the specific features shown, but that the means and construction herein disclosed comprise but one of several modes of putting the invention into effect.

Having thus described my invention, I claim:

1. In a portable gasoline engine operated tool including an engine cylinder, a spark plug, and a source of current supply connected to said spark plug, means mounted on said cylinder responsive to uncontrolled rotation of the engine of which said cylinder is a part for short circuiting to ground the current supplied said spark plug.

2. A portable gasoline engine operated tool, including an engine, an ignition system for energizing said engine, and means responsive to an uncontrolled bodily turning movement of said engine for grounding said ignition system.

3. In a portable gasoline engine operated tool having an engine and an ignition system for energizing said engine, a normally open short circuit connection to ground in said ignition system, and centrifugal means mounted on said engine and responsive to uncontrolled bodily turning movement of said engine to close said short circuit connection.

4. A portable gasoline engine operated tool according to claim 3, characterized by manual means for resetting said centrifugal means to open said short circuit connection.

5. In a portable gasoline engine operated tool having an engine presenting a cylinder head, an ignition system for energizing said engine including a spark plug mounted in said cylinder head, a short circuit connection from said spark plug to said cylinder head grounding said ignition system, means defining a gap in said short circuit connection whereby said connection normally is open, and an element movable under the influence of centrifugal force set up by an uncontrolled bodily turning movement of said engine for closing the gap in said short circuit connection.

6. In a hand operated gasoline engine powered rotary tool having an engine, a drive shaft to be rotatively driven by said engine, an ignition system for energizing said engine, a normally open short circuit connection to ground in said ignition system, and centrifugal means mounted on said engine on an approximately radial line with respect to said drive shaft and responsive to rotation of the engine around said shaft to close said short circuit connection.

7. A hand operated gasoline engine powered rotary tool having an engine, a drive shaft to be rotatively driven by said engine, said shaft rotating against the resistance of the work and being held stationary thereby should the grip of the operator be released whereupon said engine may revolve around said shaft, an ignition system for energizing said engine, and centrifugal means mounted on said engine for short circuiting said ignition system to ground in response to turning motion of the engine around the shaft.

8. In a hand controlled power operated tool, an automatic safety device for preventing gyration of an operating unattended tool, including a centrifugal device mounted on the source of power and having a part movable therein in response to uncontrolled turning movement thereof, and a power source control acting in response to predetermined movement of said part to discontinue operation of the power source.

9. In an ignition system for a portable gasoline engine operated tool, a short circuit to ground including a lead wire, a cylinder mounted on the engine and a bushing mounted in one end of said cylinder but insulated therefrom and to which said lead wire is connected, and an electrically conductive ball movable in said cylinder to establish a connection between said bushing and said cylinder in response to centrifugal force set up by an uncontrolled turning motion of the engine.

10. An automatic safety device for use on hand controlled power operated rotary tools to prevent gyration of an operating unattended tool, including a cylinder of

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electrically conductive material to be mounted on the power source of the tool, an electrically conductive element mounted in the outer end of said cylinder and insulated therefrom, an electrical lead from the power source connected to said element, and an electrically conductive ball movable in said cylinder to make common contact with said element and said cylinder and thereby deenergize the power source in response to centrifugal action set up by uncontrolled turning motion of the power source.

11. An automatic safety device according to claim 10, characterized in that the interior of said cylinder is formed with first and second intercommunicating compartments at the opposite ends thereof, said ball moving from said first compartment to said second compartment to contact said element and said first compartment presenting an inclined wall normally inhibiting such movement.

12. An automatic safety device for use on hand controlled motor operated rotary tools to prevent gyration of an operating unattended tool, including a cylinder of electrically conductive material to be mounted on the motor of the tool, the interior of said cylinder being formed with first and second intercommunicating compartments having oppositely sloping inclined walls, an electrically conductive element mounted in that end of the cylinder in which said second compartment is formed and insulated from said cylinder, an electrical lead from the motor electrically connected to said element, and an electrically conductive ball contained in said cylinder for free rolling movement, said ball normally lying in said first compartment and being movable in response to centrifugal force up the incline in said first compartment and into said second compartment where it is retained by the sloping wall therein and wherein it makes common electrical contact with said element and said cylinder to deenergize the motor.

13. An automatic safety device according to claim 12, wherein said element has the form of a bushing, characterized by a manually operable reset plunger slidably mounted in said element to push said ball from said second compartment back into said first compartment.

14. In an ignition system for a portable gasoline engine operated tool, a short circuit to ground including a lead wire, a grounded cylinder, a bushing mounted in one end of said cylinder but insulated therefrom to which said lead wire is connected, a constricted neck portion in said cylinder dividing the cylinder into inner and outer chambers, the former of which receives said bushing, an electrically conductive ball normally in said outer chamber and movable through said neck portion into said inner chamber in response to centrifugal force set up by an uncontrolled turning motion of the engine, a plunger reciprocally mounted in said bushing and presenting a head within said inner chamber to be contacted by said ball and so connect said electrical lead to ground, said plunger being accessible from outside the cylinder for manually initiated axial motion to return said ball through said neck portion to said outer chamber, thereby resetting the system for operation.

15. Short circuiting apparatus according to claim 14, characterized in that said plunger head is greater in diameter than the constricted neck of said cylinder and is so engageable with the wall of the cylinder in response to manual actuation of the plunger, whereby said plunger may be used as an emergency or temporary means of stopping the engine.

16. Short circuiting apparatus according to claim 14, characterized by a gate mounted for fore and aft swinging motion in the constricted neck of said cylinder to prevent passage of said ball therethrough in response to bouncing and rolling movements which are the result of ordinary tool operation.

17. An automatic safety device for use on hand controlled power operated rotary tools to prevent gyration of an operating unattended tool, including a cylinder of electrically conductive material to be mounted on the

power source of the tool, an electrically conductive element mounted in the outer end of said cylinder and insulated therefrom, an electrical lead from the power source to said element, an electrically conductive ball movable in said cylinder to make common contact with said element and said cylinder and thereby deenergize the power source in response to centrifugal action set up by an uncontrolled turning motion of the power source and means for inhibiting such movement of the ball in response to the disturbance of ordinary machine operation. 10

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