United States Patent

[11] 3,627,437

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[54] **TOOLHOLDER DETECTION SYSTEM**
4 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** ..... **408/16,** 340/282, 250/106 S, 408/238
[51] **Int. Cl.** **B23b 49/00**
[50] **Field of Search** ..... 77/5.2, 22; 90/11; 10/129; 250/106 R, 106 S; 340/282, 419; 116/114; 33/174

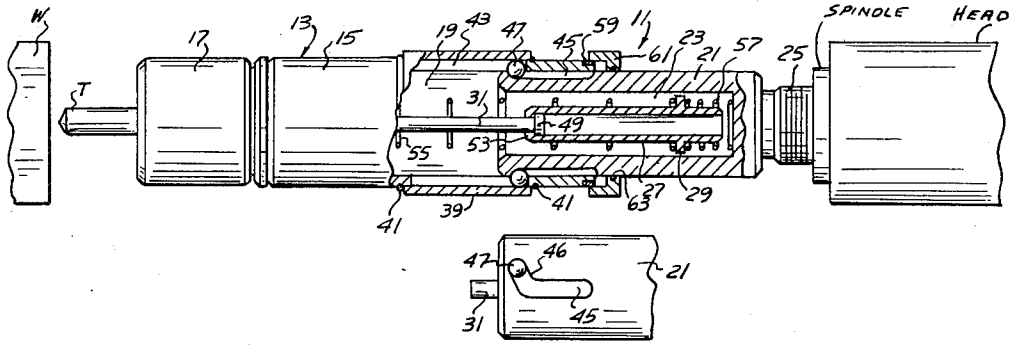
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ABSTRACT: A "no tool," "broken tool" or "improperly set tool" detection device for use with taps, drills, reamers, boring tools, counter bores and milling cutters which include a toolholder having assembled first and second parts normally biased outwardly of each other with a radioactive element on one part and a shield upon the other part normally spaced from the radioactive element and in conjunction with a radiation detection system whereby upon relative longitudinal movement of the toolholder first and second parts, said shield will protectively enclose said radioactive element, said relative movement being prevented when there is "no tool," "broken tool" or an "improperly set tool," the means for assuring said relative longitudinal movement which includes first longitudinal slots on the tool first part and corresponding laterally displaced second slots on the tool second part with angular extensions of said second slots and with balls interposed respectively between said first slots and the extensions of said second slots, whereby rotative drive delivered to said second part effects a cam action between said balls and angular extension to effect a relative longitudinal movement between said first and second parts.



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SHEET 1 OF 2

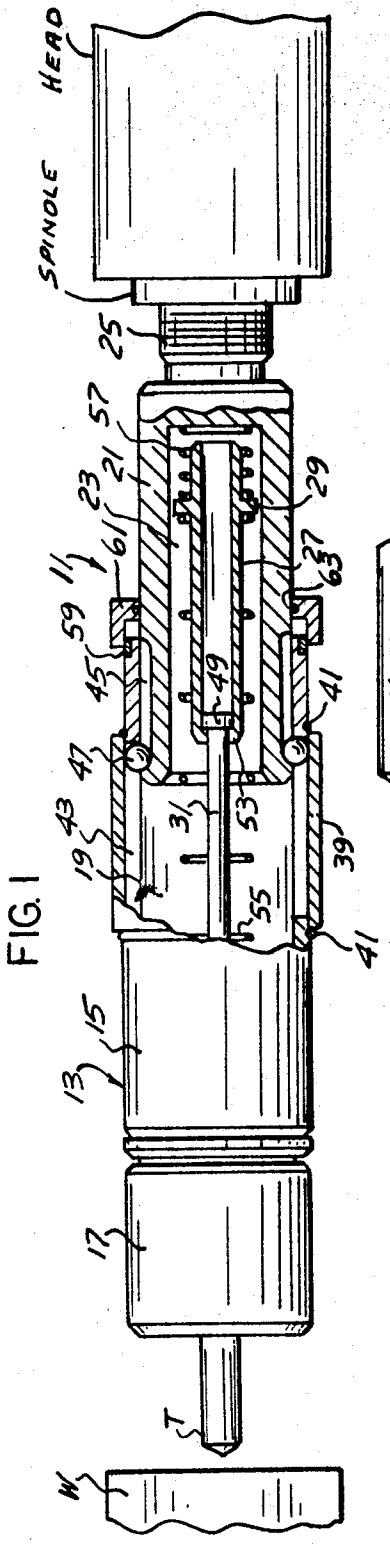


FIG. 1

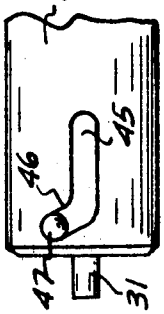


FIG. 2

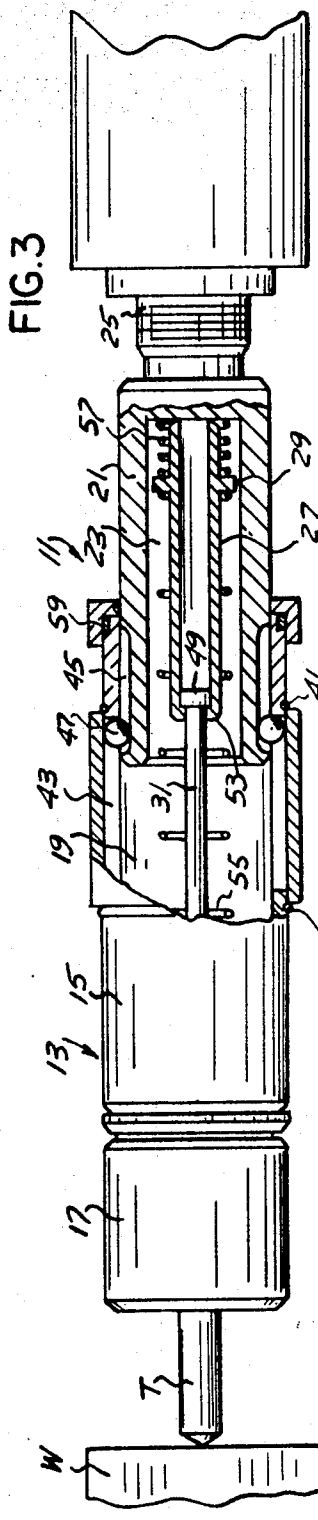


FIG. 3

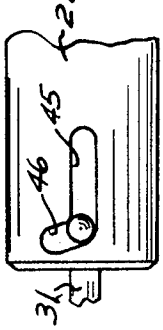


FIG. 4

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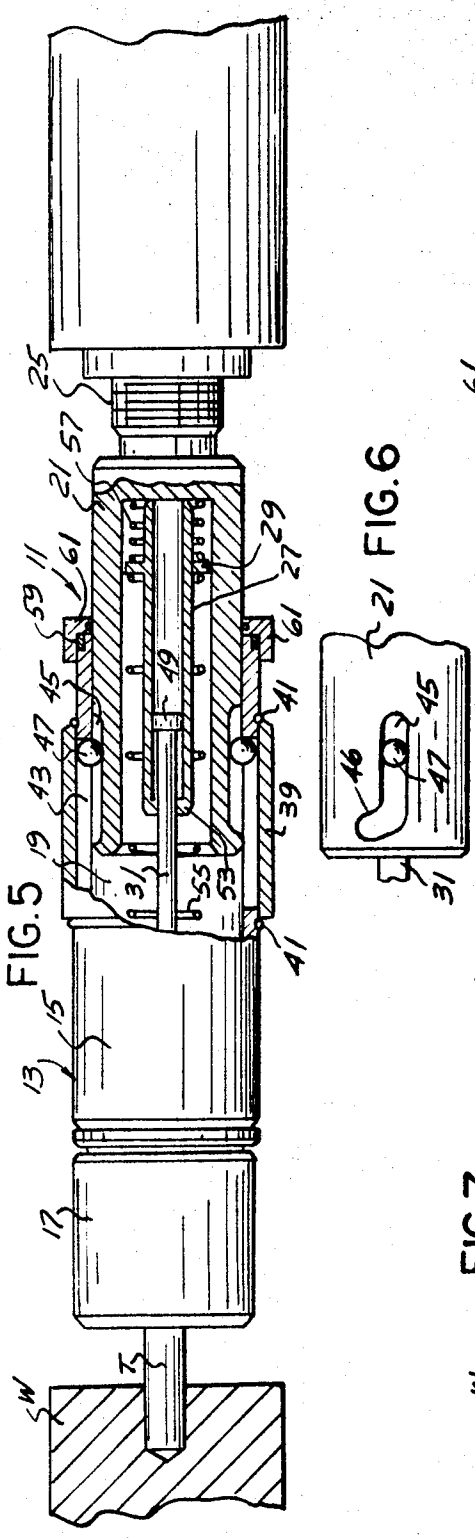


FIG. 5

FIG. 6

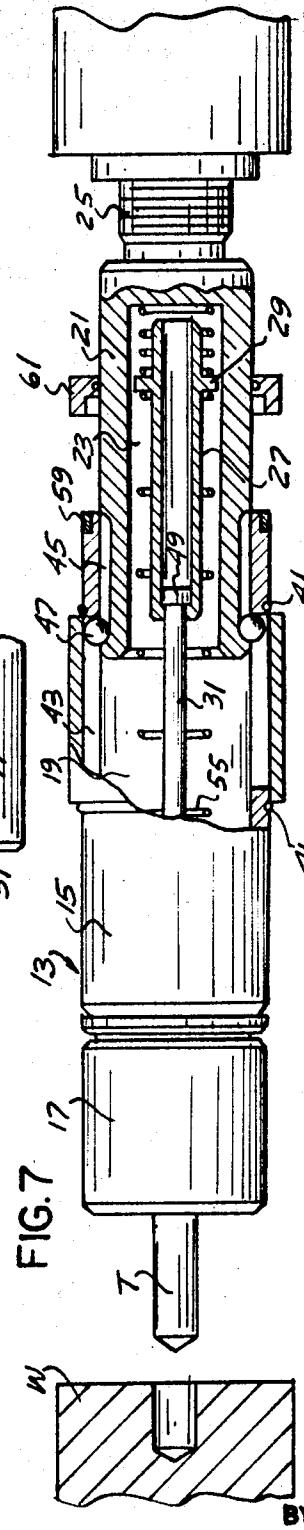


FIG. 7

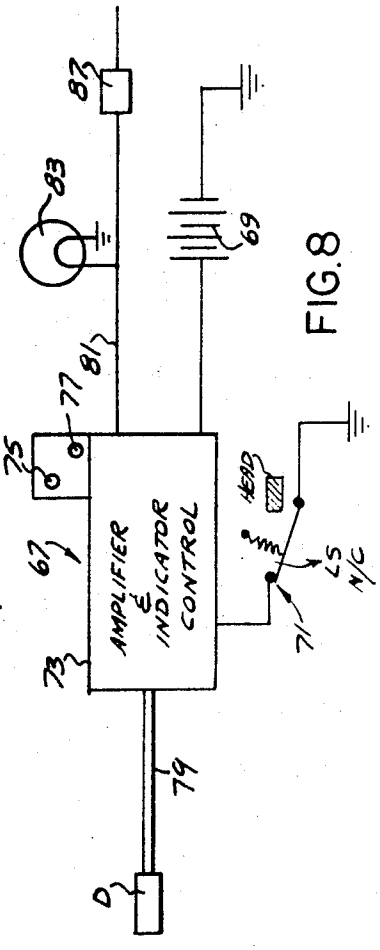


FIG. 8

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TOOLHOLDER DETECTION SYSTEM

BACKGROUND OF INVENTION

In applicant's copending Pat. application, Ser. No. 773,541 filed Nov. 5, 1968 entitled "No Tool Detection System & Method," there was disclosed a "no tool" or "broken tool" detection device adapted for use with taps, drills, reamers, boring tools, counterbores and milling cutters. In some situations, due to the effective nature of the tap or other tool employed, and a normal amount of feed pressure delivered through the tool spindle, engagement of the tool with the workpiece may initiate cutting thereof in such a manner that there may not be a normal relative longitudinal compression movement between the toolholder parts. In such situations, assuming that there is a properly set tool in position, the anticipated automatic relative longitudinal movement being absent, radioactive element remains unshielded with the result that a signal system may become activated at a time when this would be undesired.

It is an object therefore, of the present invention, to provide an improved drive connection between the first and second parts of the toolholder by which in utilizing the conventional ball and slot drive and driven relationship between said parts, one set of slots are provided with angular extensions so that upon relative rotary movement there will be a cam action between the respective balls and the angularly slotted extensions such will effect an automatic relative longitudinal compressive movement of the tool parts with respect to each other.

These and other objects will be seen from the following specification and claims in conjunction with the appended drawings in which:

FIG. 1 is a longitudinal section, partly broken away, present toolholder detection device, with the power and feed spindle and head fragmentarily shown and the workpiece fragmentarily shown.

FIG. 2 is a fragmentary plan view illustrating relative positioning of the ball and slots before contact of the tool with the workpiece.

FIGS. 3 and 4 correspond respectively to FIGS. 1 and 2 illustrating relative position of the ball and slots upon contact of the tool with the workpiece and upon rotative drive to the parts shown.

FIGS. 5 and 6 correspond respectively to FIGS. 1 and 2 illustrating the relative positioning of the ball and slot during the machining operation.

FIG. 7 is a view similar to FIG. 1 illustrating the relative position of the toolholder parts when the tool has withdrawn from the workpiece and illustrating the radioactive element as unshielded.

FIG. 8 is a schematic diagram of the electrical circuit of the radiation detection system.

DETAILED DESCRIPTION

The present "no tool," "broken tool" or "improperly set tool" detection device generally indicated at 11, FIG. 1, includes a compensating tapholder 13 having a first part 15 mounting at one end tool adapter assembly 17 mounting tap T or other tool such as a drill, a reamer, a boring tool, or a counterbore, or a milling cutter, shown spaced with respect to a workpiece W fragmentarily shown.

Within elongated bore 19 of said first part there is movably nested a second part 21 having an elongated internal bore 23 and which terminates at one end in shank 25 adapted for adjusted positioning within conventional spindle journaled and driven within a conventional head fragmentarily shown adapted for rotative drive and longitudinal feeding.

Elongated spring seat bushing 27 is loosely nested within bore 23 and includes annular flange 29 intermediate its ends. Elongated bolt 31 at one end is secured to first part 15 and its enlarged end 49 loosely and movably positioned within said bushing and retained against maximum movement in one direction by the bushing end flange 53.

In toolholders of this type there is normally provided a series of elongated first slots in the first part, a corresponding number of elongated second slots in the second part and with ball bearings interposed between the respective slots. This provides a means by which there may be relative longitudinal movement between the two parts at the same time a rotative drive relationship between the second and first parts.

Formed through the wall of the first part are a plurality of angularly displaced parallel longitudinal first slots 43 of a conventional character normally surrounded by a ball retaining cage 39 anchored by locking rings 41 to the first part.

Formed around the second part of the toolholder are a series of longitudinal parallel second slots 45 normally laterally displaced with respect to the first slots 43 respectively.

Each of the respective second slots 45 at their forward ends have angular extensions 46, FIGS. 2, 4 and 6, which normally extend at an acute angle with respect to the longitudinal axis of the toolholder. The angle would normally be in the range of 15° to 75° for illustration to thereby define in said second part corresponding angular cam surfaces.

The respective balls 47 are initially nested within the forward ends of the angular slots 46 at the same time nested within end portions of the corresponding first part slots 43.

Elongated coil spring 55 extends around bolt 31 is interposed at one end between first part 15, surrounds the bushing 27 and engages its flange 29.

A cocking spring 57 is also positioned around said bushing and is interposed between said flange 29 and one end of the second part.

Annular groove is formed within said first part within which is nested and retained a ringlike radioactive element 59.

Annular shield 61 is frictionally mounted by friction ring 63 over the second part 21 and is normally spaced with respect to said radioactive ring so as not to completely enclose the same as shown in FIG. 1.

Radiation detection system is generally indicated at 67, FIG. 8, and functions to respond to said radioactive element or ring 59 under certain conditions such as disclosed in my copending Pat. application Ser. No. 773,541, now U.S. Pat. No. 3,566,719.

Without a complete repetition of the detail and function of said detection system, the same includes detector D, amplifier and indicator control 73, "off" and "on" switch 75, reset button 77 with leads 79 and the additional lead 81 leading to visual or audible signal 83 and the control 87.

In the event that the amplifier indicator control of the detection system has been activated, failure of the shield to enclose the radioactive element will effect operation of the signal or operate the control element 87 in a manner fully disclosed in my copending application above.

The radioactive ring 59 is impregnated with a radioactive substance so that rays normally emitted from said element would be adapted to activate the radiation detector, FIG. 8, in order to indicate malfunction of the toolholder and particularly the presence of a "broken tool," "no tool" or an "improperly set tool" under certain conditions.

Detector D is of the Geiger-type, tube type adapted to sense radioactive rays when omitted from element 59. The present detector senses the exposure of the radioactive element 59 whenever there is a failure of relative longitudinal movement between the toolholder parts such as might occur if there was a "broken tool," an "improperly set tool" or "no tool" at all.

The increase in detector count rays causes the electronic circuitry to deflect a meter relay in the detection system which includes the amplifier and indicator control 73, in an electrical circuit which forms no part of the present invention, for activation of the alarm relay assembly in turn energizing alarm light 83 or other audible signal or activating the control mechanism 87.

Electronic parts of a conventional construction are available on the market sold by Eberline Instrument Co. and others. Accordingly, a further description of the radiation detection system is omitted.

Under some conditions the detection system which is disclosed in the copending application is normally deactivated by the use of the normally closed limit switch 71 so that same will not function until there has been such normal relative feed movement of the toolholder with respect to the work as would normally bring a tool into operative engagement with the work. Since the discussion of this structure forms no part of the present invention its detail is omitted.

The primary purpose of the present disclosure is to provide a means which assures that upon contact of the tool with the workpiece and with rotative drive initiated, that there will be automatically assured a relative longitudinal movement of the two parts, under normal working conditions such as would cause shield to move so as to protectively enclose the said radioactive element. Thus, the object therefore is that where there is a properly set tool functioning, there will be an assured relative longitudinal movement of the toolholder parts such as will cause a protective enclosure of the radioactive element to avoid activation of the radiation detection system.

Having described my invention, reference should now be had to the following claims. I claim:

1. In a "no tool," "broken tool" or "improperly set tool," detection device for use with taps, drills, reamers, boring tools, counterbores and milling cutters;

a first part having a bore and mounting a tool adapted to operatively engage a workpiece;

a second part having a bore and having a shank adapted for connection to a source of rotative power and longitudinal feed;

means mounting the second part within the bore of the first part for operative driving engagement therewith and for longitudinal movement relatively thereto on engagement of said tool with a workpiece;

a radioactive impregnated element mounted upon one of said parts;

and a shield mounted upon the other of said parts, normally spaced from said radioactive element;

relative movement of said parts moving said shield to cover and enclose said radioactive element;

the rays from said radioactive element adapted to energize a radiation detection system upon failure of said relative longitudinal movement due to the existence of "no tool," "broken tool" or an "improperly set tool";

the means for mounting the second part for driving engagement with the first part including a plurality of longitudinal, parallel first slots formed through said first part communicating with its bore;

corresponding parallel longitudinal second slots formed upon the exterior of said second part laterally displaced from said first slots;

the respective forward ends of said second slots having angular extensions forming camming surfaces in said second part, and balls interposed between and nested respectively in said first slots and in the angular extensions of said second slots;

whereby upon initial rotary drive of said first part, and engagement of the tool with said workpiece, the cam action between said balls and angular extensions effects a relative longitudinal movement between said first and second parts effecting such relative movement between said shield and radioactive element as to protectively enclose the same.

2. In the detection device of claim 1, a coil spring extending through said bores and interposed in compression between said first and second parts normally biasing same outwardly of each other.

3. In the detection device of claim 1, an elongated spring seat bushing within and coaxial of said second part including an annular flange intermediate its ends;

a coiled spring receiving said bushing and interposed in compression between said first part and said flange;

and a cocking spring coaxial with and receiving said bushing and interposed in compression between said flange and said second part;

retraction of said longitudinal feed and disengagement of said tool and workpiece permitting relative movement between first and second parts in the opposite direction for spacing said shield from said radioactive element.

4. In the detection device of claim 1, angular extensions of said second slots being in the range of 15° to 75° with respect to the tool axis.

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