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Stout

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[54] **OVERSPEED SAFETY CONTROL MECHANISM FOR ROTARY TOOLS**

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[52] **U.S. Cl.** ..... **51/170 T;** 51/134.5 F

[51] **Int. Cl.**[2] **B24B 23/02**

[58] **Field of Search** ..... 137/50; 415/9, 25; 418/41, 418/43; 51/165.9, 134.5, 170 T, 170 R

[56] **References Cited**

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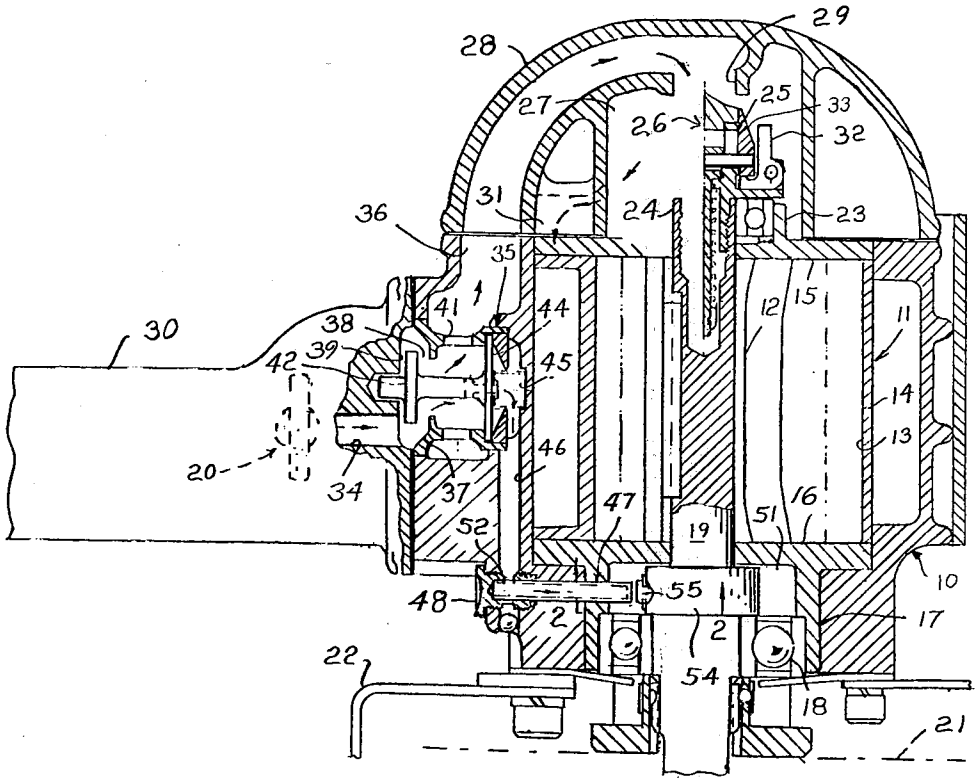
[57] **ABSTRACT**

Overspeed safety control mechanism for shutting off operating air flow to the motor of a rotary surface grinding tool when the motor overspeeds beyond a rated governed maximum, including a pneumatically balanced diaphragm operable control valve in the air inlet passage normally allowing operating air flow to the motor and adapted to be pneumatically unbalanced and forced to closed condition when at a predetermined speed level a sealing plug is ruptured by means of a centrifugally operable flyweight carried by the motor to relieve pneumatic pressure from one face of the diaphragm.

2 Claims, 2 Drawing Figures



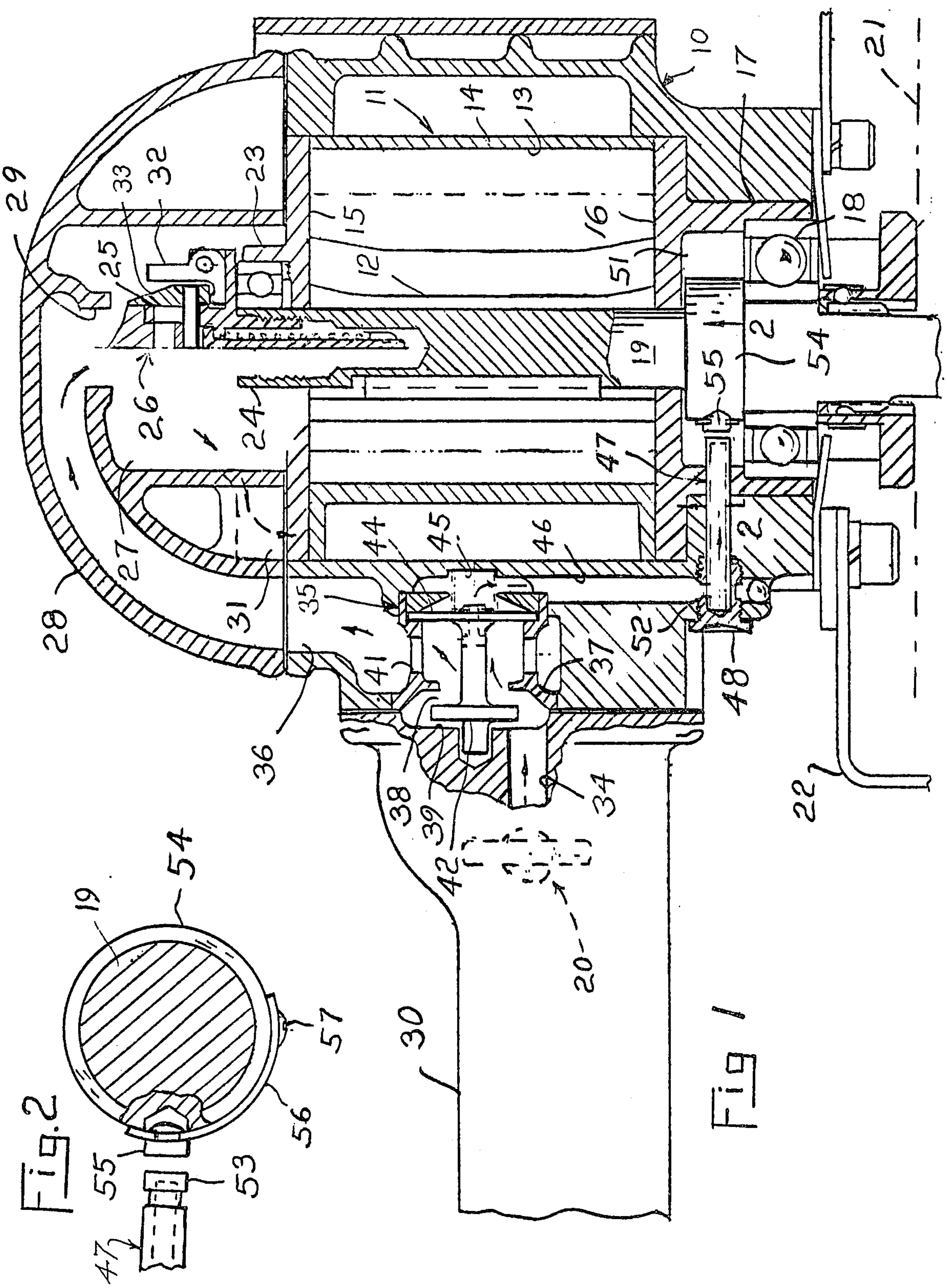


Fig 1

Fig. 2

OVERSPEED SAFETY CONTROL MECHANISM FOR ROTARY TOOLS

BACKGROUND OF THE INVENTION

This invention relates to overspeed safety control mechanism for the air motor of a rotary tool.

The invention is particularly applicable to pneumatically powered tools such as rotary surface grinders. Such tools are usually equipped with a speed governor. Speed governors are at times for various reasons subject to failure or faulty operation. Since tools of this nature are usually designed to operate at high speed, an undesirable and hazardous condition could develop should the governor fail to properly function.

Accordingly, an object of this invention is to provide mechanism to supplement the governor which will automatically operate to discontinue operation of the motor should the governor fail to operate.

Another object of the invention is to provide in a pneumatically powered rotary tool, such as a surface grinder, overspeed safety control mechanism which will respond automatically to development of a predetermined speed condition of the motor to shut off flow of operating air so as to cause the motor to come to a stop.

A further object of this invention is to provide improved and efficiently operating overspeed safety control mechanism for pneumatically powered rotary tools, particularly high speed surface grinders.

In accordance with the invention, there is provided in a rotary tool including a rotary air motor, an inlet passage for admitting live air to the motor, a manipulative throttle valve in the passage for initiating live air flow through the passage, a diaphragm operable control valve in the inlet passage between the throttle valve and the motor normally pneumatically balanced in open condition under pressure of air flowing through the passage, the passage having communication with the front and rear faces of the diaphragm, the control valve being responsive to releasing of the pressure of air communicated to the rear face of the diaphragm to move to a closed condition in the passage blocking flow of air to the motor, and means responsive to a predetermined value of centrifugal force developed by the motor to release the pressure of air communicated to the rear face of the diaphragm.

BRIEF DESCRIPTION OF THE DRAWINGG

In order that the invention may be fully understood and readily carried into effect, the same will now be described (by way of example only) with reference to the accompanying drawing of which:

FIG. 1 is a sectional view of a surface grinding tool in which the invention is incorporated; and

FIG. 2 is a section on line 2—2 of FIG. 1 directed to illustrating the relation of the frangible pressure relief plug to the centrifugally operable flyweight striking element.

DESCRIPTION OF PREFERRED EMBODIMENT OF INVENTION

Now referring to the drawing there is shown a vertical pneumatically powered surface grinding tool having a housing **10** in which is housed a rotary air driven motor **11** having a rotor **12**, here of the slidable vane type. The rotor is operable in a chamber **13** defined by a surrounding liner **14** closed over at opposite ends by end plates **15** and **16**.

A cup **17**, formed on the underface of the lower end plate **16**, is fitted with a bearing **18** in which a lower portion of the rotor shaft **19** is supported. A grinding wheel **21** (broken line) is mounted to an externally projecting portion of the shaft. The usual guard **22** protectively skirts the wheel.

A cup **23** formed on the upper surface of the upper end plate **15** is fitted with a bearing in which an upper end **24** of the shaft is supported. Shaft end **24** carries the supporting body **25** of a speed governor unit **26** located in a governor chamber **27** defined by a crown-cap section **28** of the housing, only half of the governor unit being shown for clarity of illustration.

An operating air inlet port **29** opening into the governor chamber communicates through the latter with a passage **31** leading through the upper end plate **15** to the motor chamber.

Governor flyweights **32** (one being shown) pivoted in the governor body are centrifugally responsive, accordingly as the speed of the motor varies relative to a predetermined rate, to slide a governor valve **33** against the bias of a return spring in restricting relation to the inlet port **29**, whereby flow of inlet air to operate the motor is regulated and the speed of the motor is maintained at a substantially constant rate.

The housing **10** includes a pair of laterally projecting handles, a portion of one being shown at **30** which are adapted to be held by the operator when applying the grinding wheel to the work surface.

An air passage **34** extending through handle **30** is connectible at its inlet end to an external source of operating air. The opposite end of the handle passage connects through a safety air shut-off control valve unit **35** with a passage **36** leading through the housing to the inlet port **29**. The usual lever operated throttle valve (generally indicated at **20**) which is subject to the control of the operator, is incorporated in the handle passage. When the throttle valve is actuated to its open condition, source air flows through the handle and connecting passages to operate the motor.

If for some reason, the governor should fail to effectively operate and as a result the motor should develop an overspeeding condition; that is, a rate of speed at a predetermined level above that controlled by the governor, the control valve unit will be automatically actuated to effectively shut off further flow of operating air to the motor and disable the latter from being further operated until the operator intervenes and makes any required repairs.

The control valve unit **35** includes a valve bushing **37** fitted in the housing having a valve seat opening **38** communicating upstream through a valve chamber **39** with the handle inlet passage **34**, and communicating downstream through radial ports **41** in the bushing with the housing passage **36** leading to the inlet port **29**. A diaphragm actuable control valve **42** is connected by a pilot or stem with an actuating diaphragm **44** sandwiched in the housing. Valve **42** is normally held by the diaphragm in a condition suspended in the valve chamber clear of the walls of the latter and in open relation to the valve seat, as in FIG. **1**.

It can be seen that air passing through the open valve to the communicating passages leading to the motor chamber will also exert a force on the inner face of the diaphragm **44** tending to cause the latter to close the

valve. However, it is intended that the control valve will, during normal operation of the tool, obtain a pneumatically balanced condition (as in FIG. 1) in which it remains continuously open allowing operating air flow to the motor until the balanced condition is upset. To this end, restricted ports in the valve stem allow some of the inlet air flowing through the valve seat to flow to a pressure counterbalancing or control chamber **45** at the back of the diaphragm to cunterbalance the air pressure acting upon the opposite face of the diaphragm.

The counterbalancing chamber has a pressure relief passage **46** which is normally sealed by means of a hollow frangible air releaase plug **47.** When the plug is ruptured, the pneumatically balanced condition of the valve will be upset as pressure air is dumped from chamber **45,** and the valve will abruptly close upon its seat.

The plug is supported in the housing by means of a head **48** which is threadedly engaged in the housing. The plug passes slidably and radially through the side wall of the lower bearing cup **17** into an annular vented space **51** above the lower bearing **18.**

The interior of the plug communicates by radial ports **52** in the head of the plug with the relief passage **46** and is sealed at its outer end by means of a frangible tip **53** (FIG. 2). An annular groove adjacent the tip provides a weakened area permitting the tip to be sheared off when struck a sharp blow so as to allow the pressure air to be dumped from the counterbalancing chamber.

The tip **53** of the plug is located in close radially spaced relationship to the periphery of a collar portion **54** of the rotor shaft. A flyweight **55** carried by the collar is responsive to centrifugal forces developed by an overspeeding condition of the motor to strike and shear off the tip of the plug. The flyweight is riveted to the outer face of a resilient curved spring **56** (FIG. 2). The latter is anchored at its opposite end **57** to the periphery of the collar **54.** The spring extends for about 90° about the collar lying upon the peripheral surface of the latter.

The centrifugal forces that would cause the governor weights **32** to swing outwardly to actuate in conventional manner the governor valve during normal operation of the tool are insufficient to cause the flyweight **55** to fly out to strike the plug. If, however, should the speed of the motor develop to an excessive predetermined rate, the flyweight **55** would be thrown outwardly in an orbit sufficiently to strike and shear off the tip of the frangible plug. As a consequence, the pressure air in the counterbalancing chamber **45** will be dumped through the broken plug causing the control valve **42** to become pneumatically unbalanced, close and shut off further flow of operating air to the motor.

It can be seen that once the pressure relief plug is ruptured, the valve will become pneumatically unbalanced and closed each time the throttle valve is actuated to open condition, thus disabling the tool from being further operated until the broken plug is replaced. Normally, before replacing the plug the tool would be dismantled to determine the cause of its faulty operation; and any necessary repairs would be made.

While the invention has been illustrated and described in detail herein, it is to be expressly understood that the invention is not limited thereto. Various changes can be made in the design and arrangement of the parts thereof without departing from the spirit and scope of the invention. Accordingly, it is my intent to claim the invention not only as shown and described herein, but also in all such forms and modifications as may reasonably be construed to fall within the spirit of the invention and the scope of the appended claims.

I claim:

1. In a rotary grinding tool including a grinding wheel and a pneumatically powered motor having a spindle carrying the wheel, a live air inlet chamber having an inlet connecting with a supply passage and an outlet communicating with the motor, a valve controlling air flow through the inlet, a diaphragm dividing the inlet chamber off from a pressure counterbalancing chamber, an axially extending stem operatively connecting the diaphragm with the valve, the diaphragm being responsive to inlet air pressure over a front face thereof exposed to the inlet chamber to draw the valve to a closed condition and being responsive to a counterbalancing air pressure over a rear face of the diaphragm exposed to the counterbalancing chamber to hold the valve in a normal open condition, a passage in the stem communicating the inlet chamber with the counterbalancing chamber so as to develop the counterbalancing air pressure over the rear face of the diaphragm, a relief passage connected with the counterbalancing chamber for relieving the latter of the counterbalancing pressure and as a consequence allowing the diaphragm to draw the valve to closed condition, a frangible pressure air relief plug normally sealing the relief passage against relief of the counterbalancing air pressure, and flyweight means carried by the spindle having response to development of a predetermined centrifugal force by the motor in the spindle to swing outwardly to engage and rupture the relief plug for release of the counterbalancing air pressure.

2. In a rotary grinding tool as in claim **1,** wherein the plug has an internal passage communicating with the relief passage, the flyweight means includes a curved spring fixed at one end to the spindle and carrying a flyweight at its other end, and the plug has an externally projecting frangible closure tip disposed on a level with the flyweight and in a predetermined centrifugally projected orbit of the flyweight.

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