United States Patent [19]

Gavin

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[54] **PRESSURE REDUCING AIR GUN**

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[52] **U.S. Cl.** **239/291,** 239/569

[51] **Int. Cl.** **B05b 1/28**

[58] **Field of Search** 239/291, 295, 525, 239/526, 299, 498, 518, 597, 569

[56] **References Cited**

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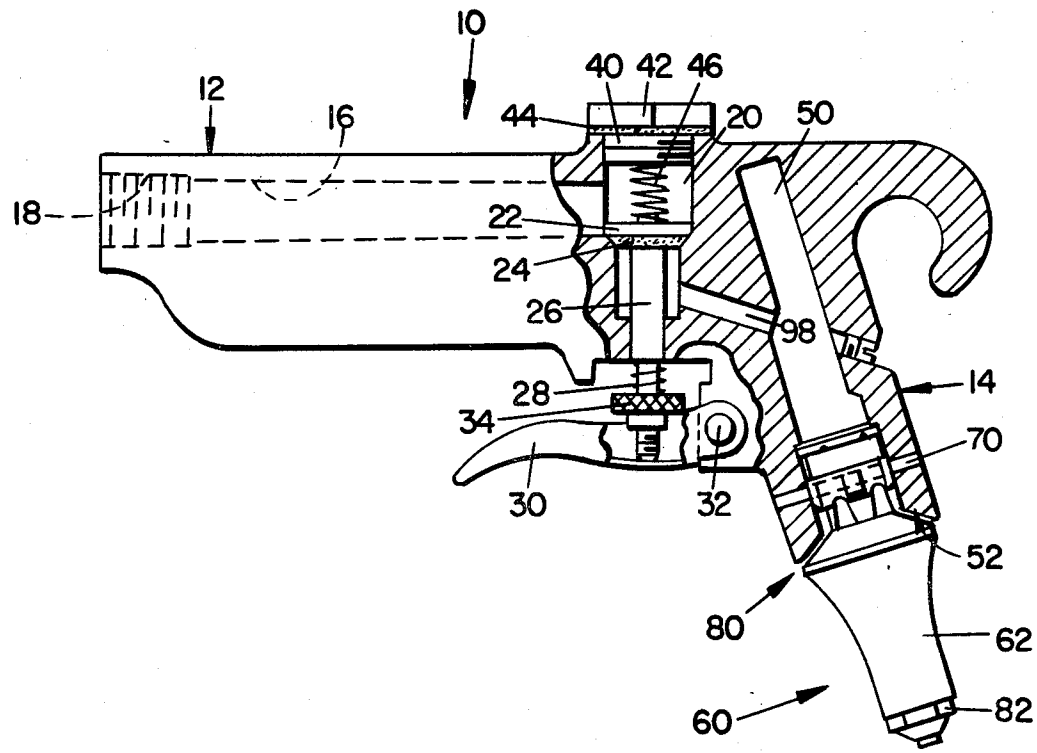
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Assistant Examiner—Michael Y. Mar
Attorney—Kenwood Ross et al.

[57] **ABSTRACT**

An air gun designed to offer extra protection in the forms of an air screen barrier developed around a main discharged air stream to reduce the danger of chip fly back and air overload pressure relief means for reducing static nozzle pressure to a value less than any value as established by any regulatory agency for safety purposes.

3 Claims, 3 Drawing Figures



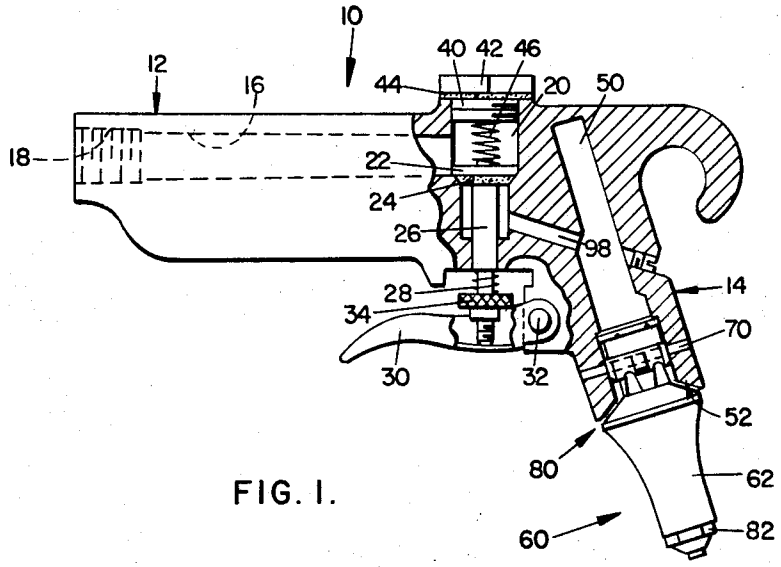


FIG. 1.

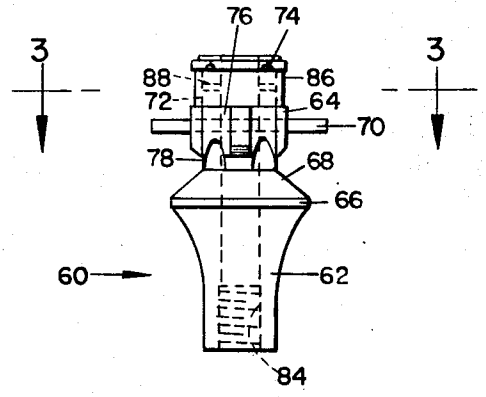


FIG. 2.

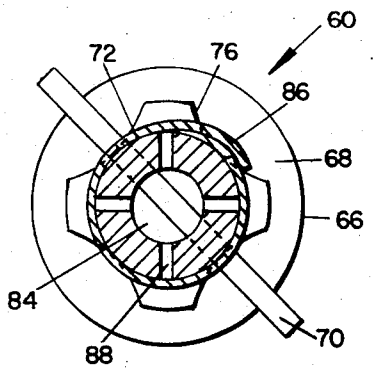


FIG. 3.

PRESSURE REDUCING AIR GUN

As known, compressed air is widely used as a power source in industry, a pressure usually in the area of 85 – 100 psi being furnished by a compressor to various air-powered instruments such as riveting guns, presses, jackhammers and like pneumatic tools. And as also known, workmen have used streams of compressed air for removing dust, metal chips and the like from work pieces, work benches and other areas.

When the workman wishes to dust, he manually opens the valve and aims the gun to direct a high-velocity, low-volume stream of air toward the object to be dusted. Lightweight particles of dust, metal chips and the like which are struck by the aim stream are accelerated thereby and fly off in various directions through the air.

Obviously, dusting by this means is a very unsafe practice and there have been many injuries attributed to flying particles being lodged in workmen's eyes and in other parts of their bodies. Other injuries result when the orifice of a gun is, as a practical joke, pushed against a workman's body or into one of his body openings. The high-pressure stream of air will pass through the epidermis and into the blood stream, with the consequent air bubbles in the blood sometimes causing immediate death.

Safety engineers have long recognized the hazards of guns with the result that in some manufacturing plants their use is forbidden.

Recently adopted governmental safety regulations have related to the sensitive problem of insuring that air pressure in air guns for cleaning purposes does not exceed 30 psi static pressure.

The requirement to reduce the static nozzle pressure to "less than 30 psi" is understood to mean that the downstream pressure of the air at the nozzle or opening of a gun used for cleaning purposes, meaning nozzle pressure, must remain at a pressure level 30 psi for all static conditions. The requirements for dynamic flow are such that, in a case where dead ending occurs, a static pressure at the main orifice shall not exceed 30 psi. This requirement is necessary in order to prevent a back pressure buildup in case the nozzle is obstructed or dead ended.

Two acceptable methods for meeting the general requirement are already known and obvious.

In the first instance, assuming the primary feed line from the compressor to such as a pneumatic tool or other use (other than a cleaning use) to be at, say, 90 psi, a secondary line for the cleaning operation may be tapped into the primary feed line, which secondary line may be interrupted with an air pressure reducer where the inlet pressure is of course 90 psi but where the outlet pressure is a lesser value. The air in the secondary line, thus reduced with respect to pressure, can then be passaged to the air gun for use in the cleaning function.

In the second instance, again assuming the feed line to be at say 90 psi, the secondary line tapped thereinto can lead directly to the gun which incorporates its own pressure reducer, capable of reducing the air pressure to a desired lower value.

The invention hereof offers another approach responsive to the government regulation.

By this invention, the dangers of a "blast" gun with its wasteful "over-kill" are obviated. Rather the gun incorporates a safety feature whereby the nozzle pressure is limited to a maximum of 30 psi, or other desired

value at normal air line pressure while yet retaining the necessary velocity for effective chip removal.

The invention combines means for facilitating the delivery of a jet of air at a predetermined pressure within a range of pressures in combination with means for projecting a conical barrier stream of air forwardly around the air jet to reduce the danger of fly-back by preventing chips and turnings or other blow-off debris dislodged by the air jet from flying back and striking the operator.

In the drawings:

FIG. 1 is a combined side elevational and longitudinal sectional view of the air gun of the invention;

FIG. 2 is an enlarged side elevational view of the nozzle of the invention; and

FIG. 3 is a view, in section, on line 2—2 of FIG. 2.

A gun body, generally represented by **10**, has a grip or inlet end **12** and a nozzle or outlet end **14** angularly related thereto.

Grip end **12** is formed with a passage **16** leading thereinto from a threaded inlet **18**, allowing connection with the flexible hose of a conventional compressed air line (not shown).

Passage **16** communicates at its inboard terminal with a circular valve well or cavity **20** in the gun body, which well is formed with an intermediate annular shoulder serving as a valve seat for a valve **22** having a usual resilient seat **24** and a lower stem **26** depending therefrom.

Valve **22** is reciprocable relative to the body so that, in closed position, as shown, the valve rests on the valve seat of the valve well to close off communication between the upper and lower regions of the valve well and in opened position, the valve is upwardly of the valve seat to allow communication between the upper and lower regions of the valve well.

A trigger **30** of conventional configuration is pivotally mounted on the body by means of a trigger pin **32** and the lower extremity of valve stem **26** extendable through a suitable opening in the gun body normally seats thereupon outboard of the trigger pin with a trigger spring **28** circumscribing the stem and a knurled manually-engageable adjusting nut **34** threadedly engaged with the lower extremity of the stem below the trigger spring.

As trigger **30** is operated upwardly, valve **22** is elevated upwardly of its seat to an "open" position thereabove. Adjusting nut **34** serves to limit upward movement of the valve and stem.

The upper wall of valve well **20** is threaded and a hex nut **42** having a depending threaded portion **40** is threadedly engaged therewith in the valve well closing function. A gasket **44** circumscribes threaded portion **40** to ensure a tight closure.

A valve spring **46** nestably seats in opposed spring seats in threaded portion **40** and valve **22** and urges the valve returnably onto its seat when the raised trigger is manually released.

Nozzle end **14** has a passage **50** leading thereinto from an outlet **52**.

A nozzle, generally indicated by **60**, comprises a tapered main body portion **62** positionable outside of the gun body and a shank or neck portion **64**, which shank portion is positionable within the gun body, by being extended into passage **50** through outlet **52**.

An annular shoulder **66** defines the rearward end and largest circumference of the main body portion, and

the shank portion is connected to the main body portion as by a tapered flared wall **68** complemental to the tapered mouth of outlet **52.**

The nozzle is secured relative to the gun body by means of a transversely-extending staking pin **70** in manner such that an annular outlet generally indicated by **80** of any desired width or thickness and resultant from the judicious spacing of tapered wall **68** from the tapered mouth of outlet **52** allows a conical air stream to pass from the gun in the form of an umbrella of air around a main air stream discharged through a central passage **84** extending through the nozzle.

The outboard end of the nozzle has a nozzle tip **82** threadedly engaged therewith and air passageway **84** extends through the aligned nozzle and nozzle tip.

Circumferentially of shank portion **64,** adjacent its upper terminal, an annular upper recess **72** is provided and the shank above the upper recess is formed with a plurality of peripherally-arranged circumferentially-disposed longitudinally-extending flutes **74** communicating with the recess. Below the upper recess, the shank is provided with a plurality of peripherally-arranged circumferentially-disposed longitudinally-extending flutes **76** likewise communicating with upper recess **72** thereabove and with another annular lower recess **78** adjacent tapered wall **68.**

An overload relief means or automatic safeguard is in the form of a spring means **86** disposed around the neck of the shank defined by the bottom wall of the recess and a plurality of radially-extending openings **88** extend through the shank in a circumferential row about the neck and communicating with central passage **84.**

The combined area of openings **88** is capable of bleeding off sufficient air from within passageway **84** to maintain the pressure therewithin at the desired safe level.

Spring means **86** which may be formed of a strip of metal or rubber is of a width equal to the width of recess **72** and of a length greater than the circumference of the recess as may be seen in FIG. **3.**

The strip may be placed in position by inserting one end in the bottom of the recess and sliding the strip around the recess circumference until it passes completely around the recess and ultimately to commence a second convolution about the neck in overlapping relation.

The fit between the edges of the strip and the walls of the recess is sufficiently loose to enable the strip to be fitted into the recess but sufficiently tight to prevent an appreciable loss of pressure or air from within passageway **88** when the strip is in its sealing position with respect to the holes. The overlapping of the ends of the strip when in the final position will result in the strips forming a complete cylinder about the area of the neck containing the holes and will effectively prevent the loss of any appreciable amount of pressurized gas from within the gun.

In the event that the pressure within the gun should rise above the maximum safe level, the internal pressure on the strip will cause it to buckle and curve in a direction normal to the direction of curvature which it has assumed as a result of being wrapped around the shank. This will cause the edges of the strip to move towards each other due to distortion of the strip and, ultimately, the strip will be sprung away from the recess walls thereby permitting the holes to spill the contents of the gun and thereby reduce the pressure to a safe level. The advantages of the pressure relief system constructed in accordance with the present invention are several and of considerable importance.

Advantage resides in the fact that the curvature of the strip which results from its being wrapped around the shank greatly increases its resistance to bending in a direction normal to the direction of primary curvature and, as a result, a strip of sheet metal or other material may be used which is considerably thinner and lighter than might otherwise be the case. The primary curvature of the strip imparts considerable rigidity to the entire assembly which enables a relatively light assembly to be used even when high pressures are contemplated.

Passage **50** in nozzle end **14** communicates with well **20** below the annular seat on the well by means of a secondary passage **98.**

Normally air entering the gun through the inlet passes through passage **16** and, when the valve is raised from its seat past the valve in the well and into and through passage **98** to and through passage **50** and outwardly of passage **84** in the nozzle and nozzle tip to atmosphere with a minor quanta of the air passing through flutes **74,** upper recess **72,** flutes **76,** lower recess **78** and passage **80** to atmosphere in the umbrella like barrier around the main air stream.

If and when the dead ending or obstructing of the nozzle occurs so that there is a back pressure buildup within passage **50,** the spring **86** is forced to rise up from its seat upon the recess wall by the force of air through passages **88** and the air thereby escapes into the recess and thence outwardly through flutes **76** and through lower recess **78** to passage **80** to atmosphere.

Release of the obstruction or termination of the dead ending allows the spring to return to its normal seated position.

I claim:

1. In an air gun having an air inlet and an air outlet and valve means therebetween:

the improvement in means for the discharge from the outlet of a mainstream air jet and an umbrella jet of air circumscribed therearound with an increase in the discharge in the umbrella jet of air during a condition of overload relief comprising:

an elongated nozzle having an elongated upper shank portion fixed in the gun with an outer surface contiguous with the inner surface of the gun and a lower main body portion extending downwardly therefrom and outwardly of the outlet,

said nozzle having a central bore longitudinally thereof for the discharge of air in the form of a mainstream jet at the outer end thereof,

the shank having an annular recess adjacent the upper end thereof and a set of peripherally arranged longitudinally extending flutes on opposite sides of the recess disposed relative to the longitudinal shank axis,

a spring means normally seated in the recess of the shank,

a plurality of radially arranged passageways extending through the shank between the seat of the spring means and the central bore of the nozzle,

the spring means lifting from its seat in the recess upon pressure build up within the central bore of the nozzle through any dead ending of the nozzle.

2. An air gun comprising in combination:

a body having an air inlet and outlet and a well provided with a valve seat therebetween,

the body having air passageways from the inlet to the well above the seat and from the well below the seat to the jet means,

a valve engageable with the seat having a stem extending through the body,

spring means urging the valve towards the seat,

a trigger operable to act on the stem to elevate the stem and valve from the seat,

internal stop means to limit movement of the valve from the seat in the form of a stop member adjustable in the well and engageable by the valve as it is elevated by the trigger means for the discharge from the outlet of a mainstream air jet and an embrella jet of air circumscribed therearound with an increase in the discharge in the umbrella jet of air during a condition of overload relief and including:

an elongated nozzle having an elongated upper shank portion fixed in the gun with an outer surface contiguous with the inner surface of the gun and a lower main body portion extending downwardly therefrom and outwardly of the outlet,

said nozzle having a central bore longitudinally thereof for the discharge of air in the form of a mainstream jet at the outer end thereof,

the shank having an annular recess adjacent the upper end thereof and a set of peripherally arranged longitudinally extending flutes on opposite sides of the recess disposed relative to the longitudinal shank axis,

a spring means normally seated in the recess of the shank,

a plurality of radially arranged passageways extending through the shank between the seat of the spring means and the central bore of the nozzle,

the spring means lifting from its seat in the recess upon pressure build up within the central bore of the nozzle through any dead ending of the nozzle.

3. In an air gun having an air inlet and an air outlet and valve means therebetween:

the improvement in means for the discharge from the outlet of a mainstream air jet and an umbrella jet of air circumscribed therearound with an increase in the discharge in the umbrella jet of air during a condition of overload relief comprising:

an elongated nozzle having an elongated upper shank portion fixed in the gun with an outer surface contiguous with the inner surface of the gun and a lower main body portion extending downwardly therefrom and outwardly of the outlet,

said nozzle having a central bore longitudinally thereof for the discharge of air in the form of a mainstream jet at the outer end thereof,

the shank having an annular recess adjacent the upper end thereof defining a pair of collars extending radially outwardly of the external surface of the recess and spaced axially of one another and a set of peripherally arranged longitudinally extending flutes in the collars on opposite sides of the recess disposed relative to the longitudinal shank axis,

a plurality of radially arranged passageways extending through the shank between the seat of the spring means and the central bore of the nozzle,

the spring means lifting from its seat in the recess upon pressure build up within the central bore of the nozzle through any dead ending of the nozzle,

a series of holes in the shank between the two collars,

a pressure relief device in the form of a strip of sheet material of a width equal to the separation between the two collars and of a length greater than the circumference of the recess,

surrounding the recess between the collars with its ends in overlapping relationship to seal the holes in the shank.

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