United States Patent [19]

Larson et al.

[11] **3,880,355**

[45] **Apr. 29, 1975**

[54] **AIR BLOW GUN**

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[22] Filed: **Apr. 8, 1974**

[21] Appl. No.: **458,968**

[52] **U.S. Cl.** **239/288.3**; 239/291; 239/526

[51] **Int. Cl.** **B05b 1/14**

[58] **Field of Search** ..... 239/288.3, 288.5, 291, 239/300, 526, 586, DIG. 22

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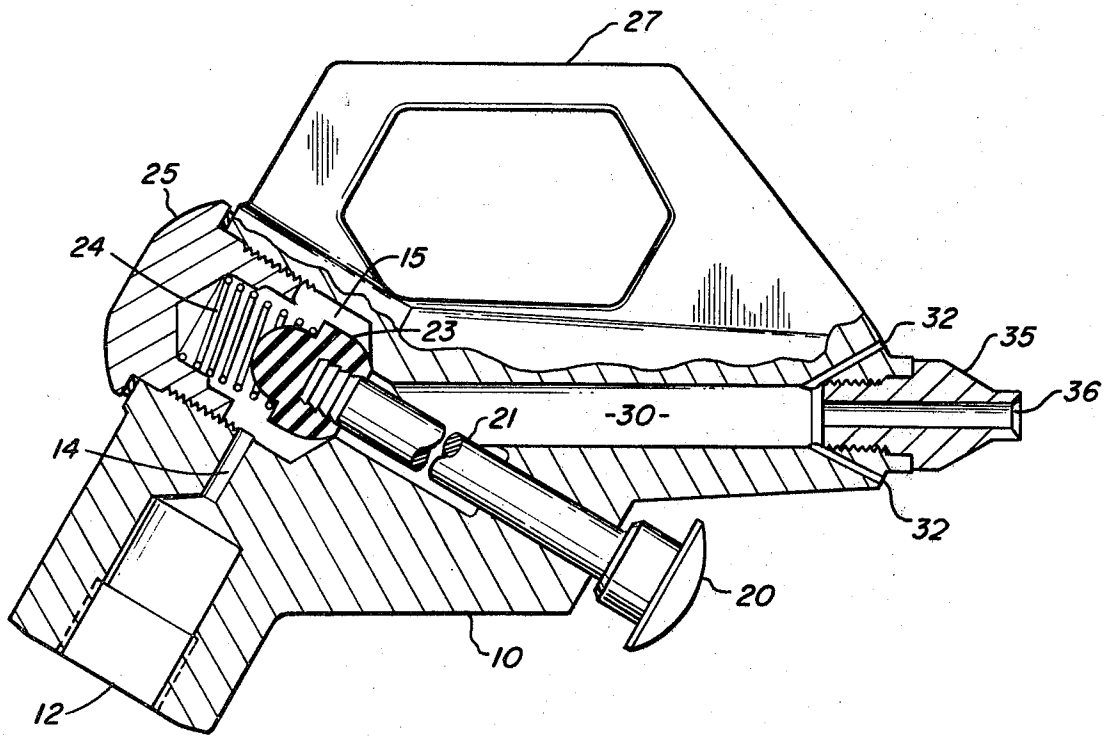
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[57] **ABSTRACT**

Apparatus is described for controllably directing a stream of pressurized air, as for use in cleaning or dusting a work area or machine part. The apparatus is gun-shaped and has an air valve trigger, and internal construction for reducing the air pressure and operating noise level, including an input orifice restriction, a valve and relief chamber, and an output construction having a nozzle and passages related thereto for providing a safety air curtain.

13 Claims, 2 Drawing Figures



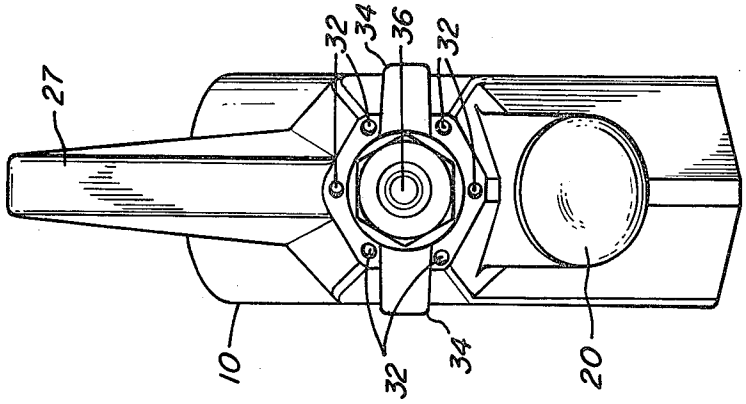


FIG. 2

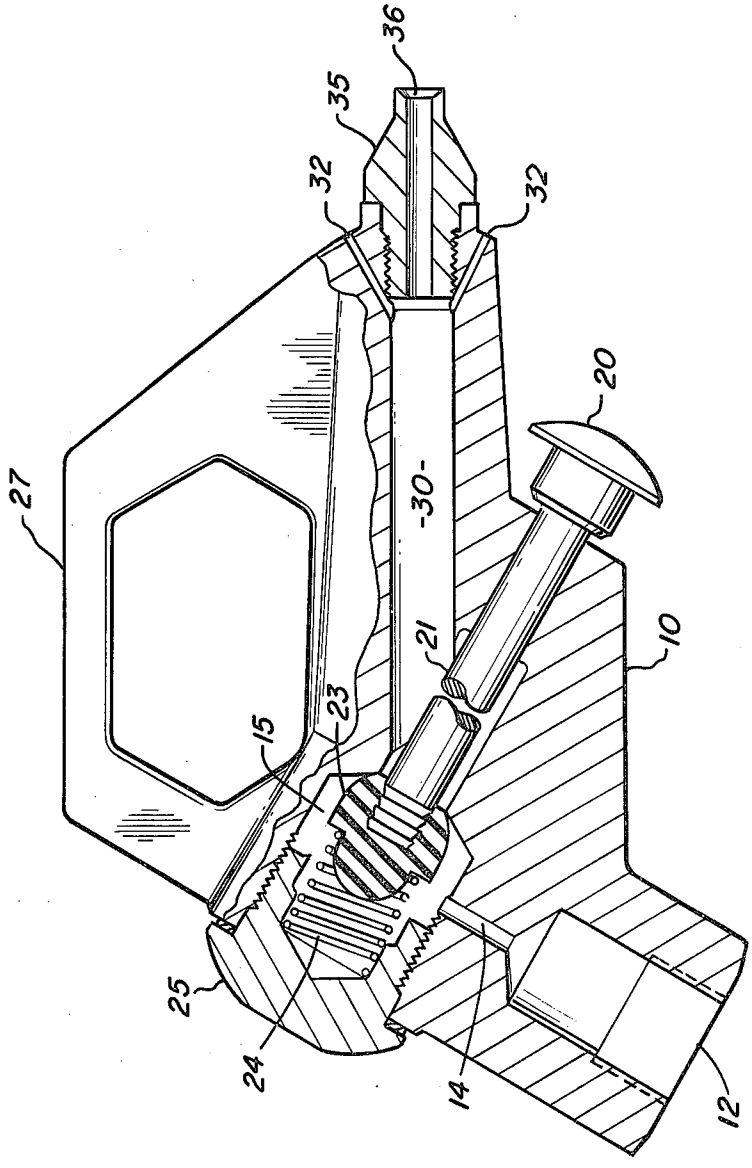


FIG. 1

AIR BLOW GUN

This invention relates to an apparatus for controllably directing a stream of pressurized air. Such devices are typically known as "air blow guns," and are commonly used in industrial and commercial establishments for cleaning and other purposes. They are, for example, useful in repair shops for blowing dirt and foreign particles from surfaces and interior chambers of machines. They are also useful in manufacturing plants for maintaining the area around a work piece clean and free from accumulation of particles.

The conventional air blow gun of the prior art typically was connected to a source of high pressure air via a hose. The connection to the hose is usually made by means of a quick-disconnect connector of a type commonly known in the prior art. Air blow guns are typically gun-shaped, having a trigger mechanism for actuating an air valve and allowing the inlet high pressure air to pass through a passage out the barrel. The outlet passage is typically terminated in an orifice for concentrating the air flow into a narrowly directed stream which results in an increase in air velocity and thereby enhances the ability of the device to dislodge particles which may be stuck to a surface. Because of the use of high pressure air, and a narrow outlet orifice, the high velocity air stream emitted from prior art air blow guns causes an extremely loud noise when the air blow gun is used. In addition, when the high pressure air stream is directed against the surface the loose particles thereon are violently blasted away from the surface and may be deflected back toward the operator's eyes. The high noise level of prior art air blow guns, as well as their inherent danger in deflecting particles back toward the operator, results in potentially hazardous operation for the operator. Recent federal safety and health regulations have created an interest in industry toward alleviating hazardous industrial tools, and the present invention has resulted from efforts directed toward these problems as they relate to air blow guns.

It is therefore an object of this invention to provide an air blow gun having an improved and lower noise level of operation;

It is another object of this invention to provide an air blow gun having an improved outlet orifice whereby protection is provided against particles being directed back toward the operator;

It is another object of this invention to provide an air blow gun having a secondary air curtain directed around the primary air flow for the purpose of shielding the operator from deflecting particles.

These and other objects will become apparent from a reading of the following specification and claims, and with particular reference to the drawings in which:

FIG. 1 illustrates a side cross-sectional view of the invention;

FIG. 2 illustrates an end view of the invention, showing particularly the outlet orifices.

The present invention comprises an apparatus which incorporates a number of operational and safety features into a single assembly so as to maximize performance while meeting pertinent safety requirements. Specifically, the invention is adapted for connection to a source of high pressure compressed air, typically 100 psi, and delivers pressurized air at a maximum pressure of 30 psi. The output portion of the invention is designed to provide an air safety curtain independent of the nozzle to protect the operator from flying objects, and also to limit output air pressure to 30 psi maximum even in cases where the nozzle is plugged or blocked.

The interior passages of the assembly are designed to provide the desired pressure characteristics while maintaining noise level below 90 db, which maximum level is specified in government noise and safety regulations. An interior air valve and chamber contributes to noise reduction and pressure drop while providing a safe air shut-off mechanism.

The assembly is manufactured from a casting which is designed to safely withstand the air pressures involved, with provision for accommodating the greatest internal pressure drop in a region of the casting which is appropriately designed for such pressures, and is potentially most protected from damage resulting from improper handling or dropping the assembly.

Referring first to FIG. **1**, the assembly is manufactured from a casting **10** which has appropriate passages cut therein and parts attached thereto as will be hereinafter described. Casting **10** has an inlet hole **12** which is threaded to accept a standard air hose fitting. Typically, an air hose capable of delivering air at 100 psi is attached to the standard fitting threaded into inlet hole **12.** The interior end of inlet hole **12** terminates in an orifice passage **14,** which connects inlet hole **12** to valve chamber **15.** The cross-sectional area of orifice passage **14** is approximately 1/25th to 1/50th that of the inlet hole **12,** so that with an inlet hole **12** drilled and tapped to receive a ¼ inch hose fitting the diameter of orifice passage **14** is approximately 0.075 inches. The length of orifice passage **14** is at least 3 diameters, so as to create an extended, small diameter passage between the high pressure air connection and the valve chamber **15.** With this construction a pressure on the order of 90 psi is achieved near the inlet of the assembly, and prior to the assembly valve mechanism and other components. Because this pressure drop is achieved near the inlet, failure of the valve mechanism or other components does not create an undue hazard due to the discharge of high pressure air. In addition, this pressure drop is accomplished in the handle portion of the assembly, which is less subject to damage from improper handling and is heavily constructed to withstand easily the normal range of pressures and pressure variations usually encountered with this type of apparatus.

The valving mechanism consists of a trigger pin **20** externally connected to the end of shaft **21,** which shaft is threaded into a valve body **23.** Valve body **23** is typically constructed of rubber or other semi-resilient material which will retain a good tight seat against the interior of valve chamber **15.** A compression spring **24** biases valve body **23** against its seat, the other end of spring **24** being held within end cap **25.** End cap **25** is threaded into casting **10** after the aforementioned valve assembly components have been inserted into valve chamber **15.** End cap **25** maintains an air pressure seal between the interior valve chamber **15** and the exterior of casting **10.** When trigger pin **20** is depressed it causes valve body **23** to be lifted away from its seat and opens an air passage between valve chamber **15** and cylindrical passage **30.** When trigger pin **20** is released, the force of spring **24,** as well as the force of the internal pressurized air, forces valve body **23** firmly against its seat and cuts off further air flow into cylindrical passage **30.**

The interior volume of cylindrical passage **30** is substantially equal to the volume of valve chamber **15.** This provides an instantaneous relief chamber within cylindrical passage **30** for compressed air trapped within valve chamber **15** immediately after trigger pin **20** is first activated. The escape of this trapped air reduces the instantaneous pressure inside valve chamber **15** and cylindrical passage **30** to approximately 1/2 air line pressure. Of course, with trigger pin **20** continually depressed, the steady state air pressure within cylindrical passage **30** is further reduced. Tests have shown the steady state pressure drop between valve chamber **15** and cylindrical passage **30** to be approximately 2–4 psi.

The downstream end of cylindrical passage **30** opens into a plurality of passages **32** and a nozzle **35.** Nozzle **35** is threaded into the end of casting **10,** and forms a pressure seal at its juncture with casting **10.** Nozzle **35** has an interior axially-aligned passage **36** which extends from cylindrical passage **30** to the exterior atmosphere.

In the preferred embodiment, six passages **32** are used. Each of these passages is inclined at an angle of substantially 30° from the access of cylindrical passage **30,** and the respective passages **32** are preferably spaced at equal distances around the circumference of nozzle **35.** The outlets of passages **32** are located on casting **10** instead of nozzle **35,** so that the safety features provided by these passages cannot be frustrated by removal or attempted modification of nozzle **35.** Passages **32** serve to provide a conical curtain of pressurized air which opens away from the operator and tends to deflect flying particles from the operator. A number of passages **32,** either greater or lesser than six, could be used to accomplish a similar purpose. However, tests have shown that six passages **32** serve to create an effective air shield to protect the operator. Also, the angle of inclination of passages **32** could be modified to accomplish the same purposes, although suitable results have been obtained with the passages drilled as described.

The sum of cross-sectional areas of passages **32** is substantially equal to the cross-sectional area of passage **36.** Area matching in this manner maximizes the effectiveness of the air shield without unduly degrading the cleaning effectiveness of the air stream from passage **36.** If the cross-sectional areas of passages **32** are increased relative to passage **36** a resulting drop in cleaning air flow occurs. Conversely, if the cross-sectional areas of passages **32** are decreased to a value less than the area of passage **36** the air flow creating the air shield drops below that of the cleaning air flow through passage **36.** The proper balance appears when the cross-sectional areas are approximately equal; in this relationship as much air flow is available for deflecting particles as is used for cleaning. Therefore, any particle dislodged by the cleaning air flow through passage **36** will accumulate no more energy in terms of its velocity of travel than can be dissipated or deflected by the air shield flow through passages **32.** Therefore, the probabilities are low that a particle deflected or dislodged by air through passage **36** will have sufficient energy to pass unimpeded through the air shield provided by passages **32.**

The ratio of the total cross-sectional areas of passages **32** together with passage **36,** to the cross-sectional area of orifice passage **14** is in the range of 6–10. This ratio enables most of the pressure drop from the high pressure air line to be maintained within the gun and in the region including orifice passage **14** as previously described. In addition to providing a safer pressure drop operation, this ratio together with the other structural features internal to casting **10** greatly reduces noise level caused by air flow. The preferred embodiment utilizes an **8/1** area ratio between passages **32,** taken together with passage **36,** to orifice passage **14.** With these values, the internal pressure drop is kept within safe limits even in the event that passage **36** becomes plugged or clogged. In this event, the area ratio drops to 4/1, which is effective to keep the pressure in cylindrical passage **30** below 30 psi maximum. In all cases the noise level caused by air flow through the passage **36** and all passages **32** is well below 90 db, which is the maximum safe noise level specified in pertinent government regulations relating to safety and noise.

FIG. **2** illustrates the end view of the invention. The spacing of passages **32** around nozzle passage **36** is evident in this figure. A further feature illustrated in FIG. **2** is a pair of shoulders **34** formed from casting **10.** Shoulders **34** are structural members extending to near the nozzle **35** end of casting **10,** and serve to strengthen the casting from improper handling. These shoulders are designed to accept physical shock caused by dropping or mishandling the apparatus, to prevent such mishandling from weakening or damaging the critical operational features of the apparatus. A further advantage of shoulders **34** is to prevent the intentional blocking of passages **32,** as by wrapping tape around the gun end, in an attempt to improve the nozzle passage air flow. Shoulders **34** create an irregular surface in the region of the outlets of passages **32** and thereby make it difficult to circumvent the desirable safety features provided by these passages.

A suitable handle **27** is also formed as a part of casting **10.** This handle enables the apparatus to be hung when not in use, and can be used to form a portion of the hand grip when the apparatus is being used. Although handle **27** is shown in the form of an enclosed loop in the figures, any other shape convenient for the purposes described would be suitable.

Other modifications could be made to the apparatus described herein, within the intended scope of this invention. The preferred embodiment has been found to provide a suitable compromise between operational efficiencies and important safety considerations. This compromise could be varied in one direction or another without unduly sacrificing either safety or effective operation.

What is claimed is:

1. An apparatus for controllably directing a stream of pressurized air by actuation of an internal air valve, comprising:

a. an inlet passage adapted for connection to the source of pressurized air;

b. an orifice passage of cross sectional area 1/25th to 1/50th of said inlet passage, communicating with the interior end of said inlet passage and having a length of at least 3 times its diameter;

c. a valve chamber communicating with said orifice passage, said valve chamber housing said internal air valve;

d. an outlet nozzle having a nozzle passage for directing said air stream and having means for connecting said passage to said valve chamber, the volume

of said nozzle passage being substantially equal to the volume of said valve chamber;

e. a plurality of air shield passages circumferentially arranged around said nozzle passage and radially and forwardly outwardly inclined from said nozzle passage axis, said shield passages communicating between said internal air stream and the exterior of the apparatus; and

f. means for activating said internal air valve.

2. Apparatus as claimed in claim **1,** further comprising means for structurally protecting said nozzle passages and air shield passages, said means being axially aligned with said nozzle passage.

3. The apparatus of claim **2** wherein said means for structurally protecting further comprises at least two shoulders extending forwardly to a region substantially adjacent the exterior outlets of said air shield passages.

4. The apparatus of claim **3,** wherein said nozzle passage is formed within a removable nozzle, and said removable nozzle is threadably attached to said apparatus.

5. The apparatus of claim **4** wherein the number of said air shield passages is six.

6. The apparatus of claim **5,** wherein the angle of inclination of said air shield passages relative to the axis of said nozzle passage is substantially 30°.

7. The apparatus of claim **1** wherein the means for activating said internal air valve further comprises a rod attached to said valve and slideably and sealably extending to the exterior of said apparatus.

8. An air blow gun apparatus having a trigger-actuated internal air valve for directing pressurized air, comprising:

a. an inlet passage adapted for connection to a source of pressurized air;

b. an internal valve chamber for housing said air valve;

c. an orifice passage of lesser diameter than said inlet passage and of length at least 3 times its diameter, communicating between said inlet passage and said valve chamber;

d. an outlet passage communicating with said valve chamber, said outlet passage having an internal volume substantially equal to the internal volume of said valve chamber;

e. a nozzle passage connected to said outlet passage and extending exterior of the gun; and

f. a plurality of shield passages connected between the outlet passage and gun exterior, said shield passages being symmetrically aligned about the axis of said nozzle passage and inclined radially and forwardly away from said nozzle passage, the total cross sectional area of said shield passages being substantially equal to the cross sectional area of said nozzle passage.

9. An apparatus as claimed in claim **8,** further comprising means for structurally protecting said nozzle passages and shield passages, said means being axially aligned with said nozzle passage.

10. The apparatus of claim **9** wherein said means for structurally protecting further comprises at least two shoulders extending forwardly to a region substantially adjacent the exterior outlets of said air shield passages.

11. The apparatus of claim **10,** wherein said nozzle passage is formed within a removable nozzle, and said removable nozzle is threadably attached to said apparatus.

12. The apparatus as claimed in claim **11** wherein the angle of inclination of said shield passages is substantially 30° relative to said nozzle passage, and the number of shield passages is six.

13. The apparatus of claim **12** wherein the area of said orifice passage is 1/25th to 1/50th the area of said inlet passage.

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