United States Patent [19]

Waggoner

[11] **3,844,485**

[45] **Oct. 29, 1974**

[54] **SPRAY APPARATUS**

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[73] Assignee: **Hagen Manufacturing Company,** Delphos, Ohio

[22] Filed: **Aug. 10, 1973**

[21] Appl. No.: **387,263**

[52] **U.S. Cl.** **239/420,** 239/422, 239/427, 239/543

[51] **Int. Cl.** **B05b 7/08,** B05b 1/26

[58] **Field of Search** 239/8, 420, 422, 424.5, 239/425, 427, 427.3, 427.5, 428, 429, 430, 433, 543–545

[56] **References Cited**

UNITED STATES PATENTS

2,433,463	12/1947	Lampe	239/422 X
2,585,133	2/1952	Kempthorne	239/422
3,038,750	6/1962	Nielsen	239/544 X
3,121,639	2/1964	Bauer et al.	239/545 X
3,214,103	10/1965	Kempthorne	239/422
3,565,345	2/1971	Moltzan	239/543 X
3,606,154	9/1971	Tufts	239/8

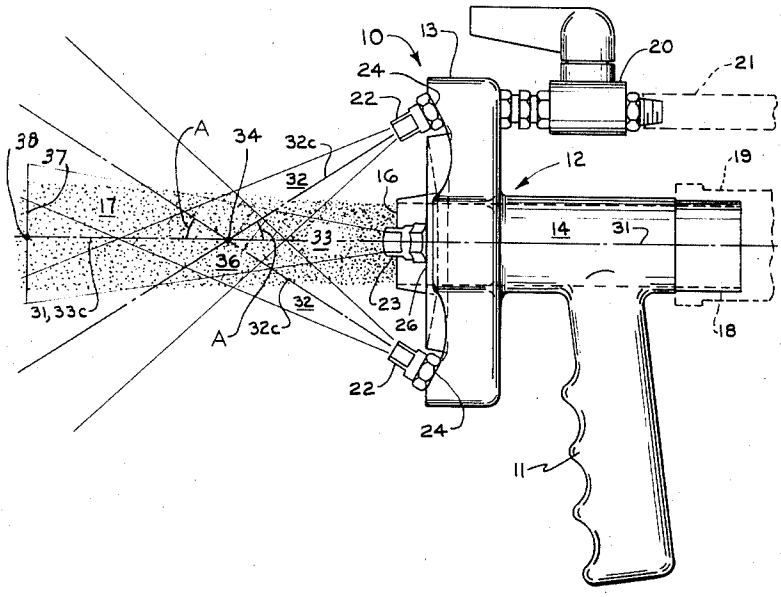
Primary Examiner—Robert S. Ward, Jr.

Attorney, Agent, or Firm—Richard D. Emch; Thomas M. Freiburger

[57] **ABSTRACT**

The invention is a spray gun for mixing a liquid with a dry fibrous or particulate substance while the substance is being applied to a substrate. A central cylindrical bore directs the discharge of dry material while a plurality of pairs of spray nozzles, situated on two different circles around the bore, spray an adhesive or other liquid into the dry material stream. Each nozzle of a pair is located in diametric opposition to the other. The spray nozzles are slotted to produce fan-shaped sprays, all slots being aligned parallel to a vertical line bisecting the gun. Although each pair of nozzles produces a line of spray intersection through the cylindrical stream of dry material, the intersection lines fall at different points along the length of the stream. This configuration maximizes the mixing characteristic of the gun, holding dry material drop off down to about 5 percent or less.

5 Claims, 4 Drawing Figures



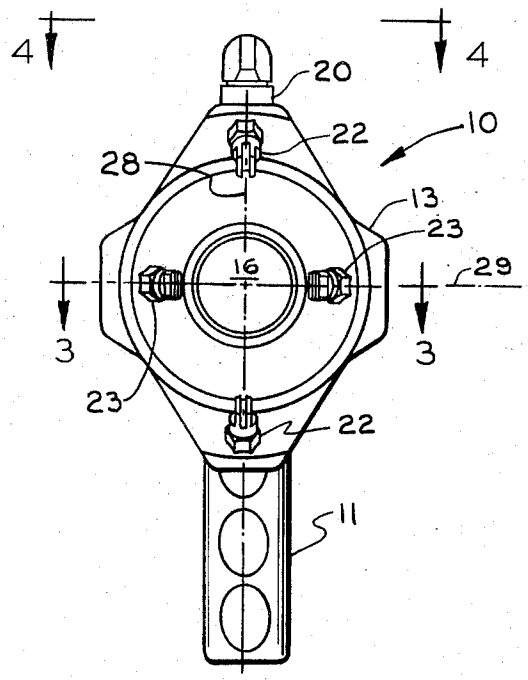


FIG. 2

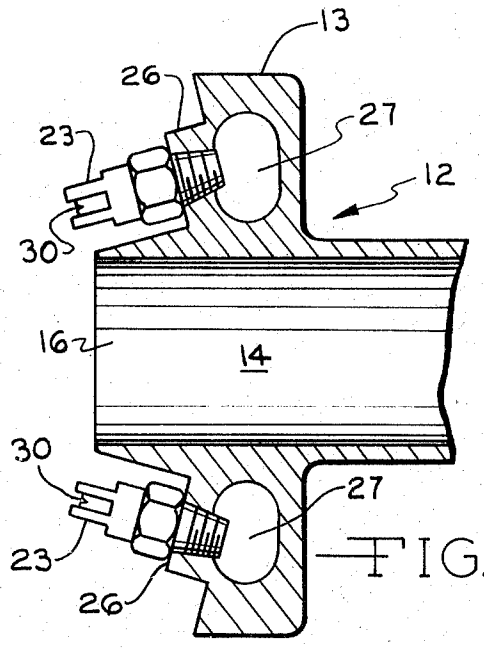


FIG. 3

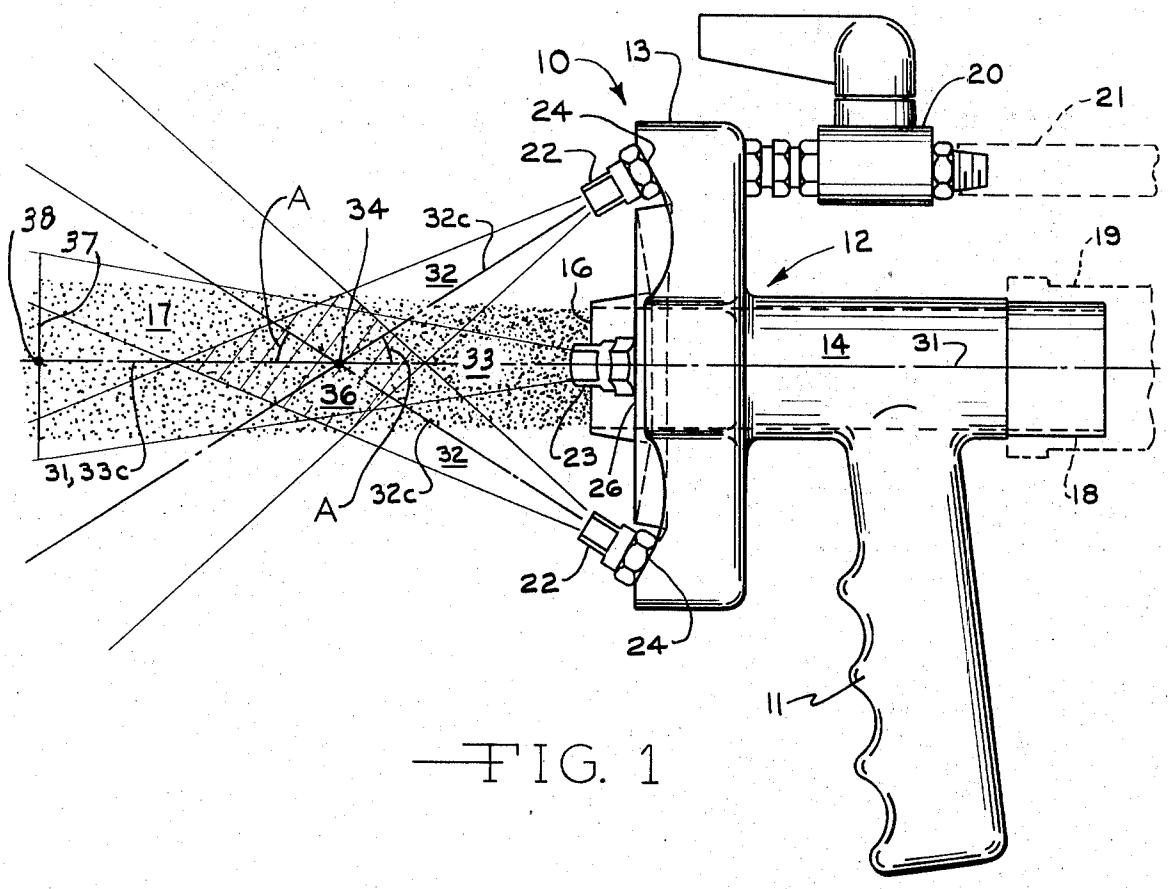


FIG. 1

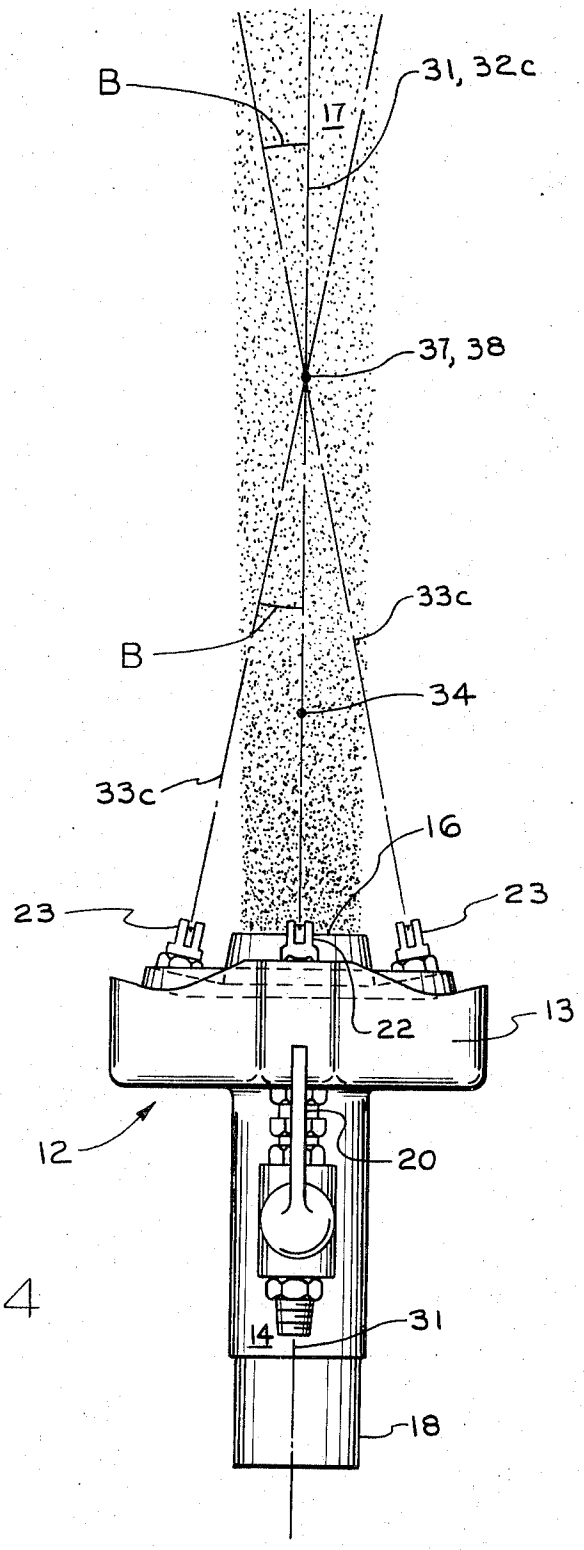


FIG. 4

SPRAY APPARATUS

BACKGROUND OF THE INVENTION

The invention relates to apparatus for applying a mixture of dry fibrous or particulate material and a liquid onto a surface, and more particularly to a spray gun or nozzle for this purpose. The apparatus of the invention is particularly useful for the mixing of a liquid adhesive with a dry cellulose insulation material during application to a substrate such as a wall, ceiling, beam, pipe, duct, etc.

Prior art spray guns intended for the purpose of this invention have employed a variety of designs for coating the dry particles with the liquid. A spray gun according to the present invention is generally of the type shown in U.S. Pat. No. 3,606,154 having a plurality of liquid spray nozzles surrounding a central dry material orifice for spray coating the dry material as it exits the orifice. However, a persistent problem with prior art spray guns has been the loss of dry material during spraying. Dry material not adequately coated or impregnated with adhesive will fall from the work surface and be wasted. As discussed in the above-mentioned patent, some prior systems have involved a drop off rate of up to 50 percent. The apparatus according to the above-mentioned patent employs a plurality of flat, fanshaped liquid sprays slicing into an oval shaped dry material stream, reportedly resulting in a drop off rate of less than 10 percent. The four liquid jets of the patented gun are located around the oval shaped dry material orifice, two slightly offset from its major axis and two from its minor axis. The slots in the jets are all arranged parallel to the major axis of the oval orifice. Although the two converging fan streams from the jets on the minor axis intersect somewhere in the dry material stream the two major axis jets are offset and their converging streams are stated not to intersect for better wetting of the dry particulate material.

SUMMARY OF THE INVENTION

The present invention provides an improved spray gun for mixing a liquid with a dry material during application. The design of this invention facilitates intermingling of liquid adhesive with dry cellulose insulation material such that the gun is capable of operating at a drop off rate below 5 percent and usually 2 percent or below. This results in a substantial reduction in both dry material and adhesive used on a job, with corresponding economic savings. Instead of an oval shaped dry material orifice, the spray gun of the present invention utilizes a circular orifice. Around this dry material orifice are spaced at least two pairs of slotted liquid jets, all of the slots of which are parallel to a vertical line through the face of the dry orifice.

The fan-shaped liquid streams all converge on the dry stream. However, at least one pair of streams lie in a single plane, their centerlines intersecting at a first point in the dry stream. A pair of fan streams from another pair of jets lie in two converging planes, their stream centerlines intersecting at a second point in the dry stream non-coincident with the first.

It is not clearly understood why this particular spray gun design with its cylindrical dry orifice and specific jet arrangement, more particularly described in the following description, results in a more efficient operation. The design was determined through experimentation and it has been found that the present apparatus produces a superior wetting of the dry material and a minimal drop off rate.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of a spray apparatus according to the present invention, indicating spray patterns;

FIG. 2 is a front elevational view of the spray gun;

FIG. 3 is a sectional view of the spray gun taken along the line 3—3 of FIG. 2; and

FIG. 4 is a diagrammatic plan view of the spray gun and spray patterns indicating points of spray intersection of the diametrically opposed slotted nozzles.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring to FIG. 1, spray apparatus according to the invention is generally indicated by the reference number **10**. The spray gun **10** includes a handle **11** and a body **12** having a face section **13** and a cylindrical bore **14**. The bore **14** has a frontal orifice **16** for discharge of dry fibrous or particulate material **17** and a rear fitting **18** for attachment to a dry material supply **19**. The gun **10** is commonly used at a distance of 4 to 6 feet from a substrate (not shown).

Connected to the face section **13** is a valved liquid supply fitting **20** which receives a liquid supply line **21**. The pressurized liquid, which is an adhesive when the gun **10** is used to apply insulation material, is conducted through the face section **13** to a plurality of liquid spray jets **22** and **23** which are mounted preferably by threaded connections in boss areas **24** and **26** of the face section **13**.

Turning to FIG. 3, the face section **13** of the body **12** is shown in section. Channels **27** through the face section **13** conduct the pressurized liquid to the spray nozzles **22** and **23**.

As best seen in FIG. 2, the liquid spray jets **22** and **23** are spaced peripherally around the central dry material orifice **16**. Jets marketed by Spraying Systems Co. of Bellwood, Ill., designated No. 40015, have been determined very satisfactory for this use. Best results have been obtained with liquid adhesives under a pressure of from about **165** to **225** pounds per square inch. The gun **10** operates very efficiently with only four jets, two **22** lying in diametric opposition on a first line **28** bisecting the orifice **16** and two **23** in diametric opposition on a second line **29**, normal to the first, bisecting the orifice **16**. Slots **30** of the slotted jets **22** and **23** are all arranged parallel to the first line **28**. In this preferred embodiment, the spacing of the jets **22** from the orifice **16** is greater than that of the jets **23**. Although the handle **11** of the gun **10** is shown on the line **28**, it may extend in any direction from the body **12** of the gun **10**.

As indicated in FIGS. **1, 2. 3.** and **4**, the liquid spray nozzles **22** and **23** all converge toward an axis **31** of the dry material bore **14** and orifice **16**. The bosses **24** and **26** provided on the face section **13** are angled as necessary. Optimum results have been obtained with the angles A, defining the direction of jets **22**, being from about 30° to 35° (preferably about 34°) and the angles B, defining the direction of jets **23**, being from about 8° to 12° (preferably about 10°). The jet slots **30** of the jets **22** are each spaced from about 1 ¼ to 1 ¾ inch (preferably about 1 ½ inch) from the axis **31** of the orifice **16** and the slots **30** of the jets **23** are each spaced

from about ¾ to 1 ½ inch (preferably about 1 inch) from the axis **31.** The orifice **16** preferably has a diameter of from about 1 to 1 ½ inch, but this dimension appears to be less critical.

FIGS. **1** and **4** illustrate the intersections of the fan-shaped sprays from the jets **22** and **23** and their relationship to one another and to the dry material stream **17.** FIG. **1** shows fan-shaped sprays **32** from jets **22** and fan-shaped sprays **33** from jets **23** in side view. Their centerlines are referenced **32c** and **33c** respectively. FIG. **4** shows the spray centerlines **32c** and **33c** in plan view, where the sprays **32** and **33** would appear narrow, almost as lines.

An intersection point **34** of the centerlines **32***c* falls in the dry material stream **17** approximately on the axis **31** of the orifice **16.** An intersection area **36** of the fan streams **32** is shown in FIG. **1.**

The two fan streams **33** intersect in a line **37** passing through the dry stream **17.** A point **38** on the line **37** represents the intersection of the stream centerlines **33c** as illustrated in FIGS. **1** and **4.**

If the slots **30** of the jets **22** and **23** lie approximately flush with the orifice **16,** then the jets **22** arranged according to the angles and dimensions discussed above would produce a stream intersection point **34** and area **36** in the neighborhood of 2 ¼ inch out from the orifice **16.** The jets **23** if so arranged would produce a more remote intersection line **37** and point **38** around 5 ¾ inch from the orifice **16.** Thus both pairs of liquid fan streams **32** and **33** slice into the cylindrical dry material stream **17** but at different angles and with different points of intersection.

The above described preferred embodiment provides a spray mixing apparatus capable of applying an almost saturated mixture to a surface. When used with dry fibrous or particulate cellulose insulation material and liquid adhesive, the apparatus yields an almost ideal mixture which adheres to all common substrates and to itself with negligible waste of dry insulation material. Coatings of up to 1.25 inches in a single application are common with the spray apparatus of the invention. Various other embodiments and alterations of the preferred embodiment, such as the provision of additional liquid spray nozzles or slight alteration in nozzle arrangement, will be apparent to those skilled in the art and may be made without departing from the spirit and scope of the following claims.

What I claim is:

1. A spray gun for mixing a liquid with a dry material while the dry material is being thrust from the gun, said spray gun comprising

a body,

an elongated dry material bore defined by said body, such bore having a circular dry material outlet orifice, such bore being suitable for supplying dry material for ejection through said orifice, whereby a generally cylindrical dry material stream is ejected,

a plurality of pairs of slotted spray nozzles mounted in said body circumjacent said orifice, each of said spray nozzles having an elongated slot orifice and each of said slot orifices being aligned parallel to a single line extending in a direction normal to the longitudinal centerline of said bore, said nozzles being adapted to eject flat fan-shaped streams of liquid, said nozzles being oriented such that a first of said pairs of nozzles ejects both of its fan-shaped streams in a single plane, said streams of said first pair having centerlines intersecting in a point within said dry material stream, and such that a second of said pairs of nozzles ejects its fanshaped streams convergingly to intersect in a line lying in said single plane and non-coincident with such point,

liquid supply means for supplying a liquid to said plurality of pairs of nozzles, and

valve means in communication with said liquid supply means for regulating the rate of flow of the liquid to said plurality of pairs of nozzles.

2. A spray gun, according to claim **1,** wherein said body has a liquid inlet and said liquid supply means includes a plurality of interior passageways defined by said body and communicating between said spray nozzles and said liquid inlet and a liquid fitting assembly extending outwardly from said liquid inlet.

3. A spray gun, according to claim **2,** wherein said valve means comprises a valve positioned in communication with said liquid fitting assembly.

4. A spray gun, according to claim **3,** wherein such bore defines a longitudinally extending centerline and each of said first pair of nozzles has a spray centerline which defines an angle with said bore centerline of between 30° and 35°.

5. A spray gun, according to claim **4,** wherein each of said second pair of nozzles has a spray centerline which defines an angle with said bore centerline of between 8° and 12°.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,844,485 Dated October 29, 1974

Inventor(s) Robert A. Waggoner

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

The line designated "Inventor: Robert A. Waggoner, Allen, Ohio" should read "Inventor: Robert A. Waggoner, Spencerville, Ohio"; and

The line designated "Assignee: Hagen Manufacturing Company, Delphos, Ohio" should read "Assignee: U. S. Fiber Corporation, Delphos, Ohio".

Signed and sealed this 14th day of January 1975.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

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