United States Patent [19]

Krohn

[11] **3,836,082**

[45] **Sept. 17, 1974**

[54] **TRIGGER ASSEMBLY FOR A SPRAY GUN**

[75] Inventor: **Duane D. Krohn,** Arvada, Colo.

[73] Assignee: **Binks Manufacturing Company,** Franklin Park, Ill.

[22] Filed: **Aug. 1, 1973**

[21] Appl. No.: **384,687**

[52] **U.S. Cl.** **239/526,** 239/569

[51] **Int. Cl.** **B64d 1/30**

[58] **Field of Search**.... 239/569, 581, 582, 583–585, 239/526

[56] **References Cited**

UNITED STATES PATENTS

1,969,205	8/1934	Carr et al.	239/526
2,936,959	5/1960	Nord et al.	239/569 X

Primary Examiner—Robert S. Ward, Jr.

Attorney, Agent, or Firm—Gray, Juettner, Pigott & Cullinan

[57] **ABSTRACT**

In a spray gun or the like having a valve held in closed position under fluid pressure and a trigger for opening the valve, a lever is pivotally connected to the trigger at one end, abutted against a stop at the other end, and provided with an arcuate intermediate portion in direct engagement with the valve opening rod or stem to provide a compound lever action to facilitate opening the valve against the fluid pressure. The trigger also includes a flanged portion that is slightly spaced from the lever in valve closed position, but brought into engagement with the lever after initially opening the valve against high pressure and after the pressure has equalized, so that the trigger then assumes a conventional relationship and feel relative to the valve. The mechanism is particularly useful in guns which dispense viscous materials and have large valve surfaces, wherein the force required to initially open the valve is considerable.

The trigger assembly also incorporates a safety device for the operator's protection.

6 Claims, 3 Drawing Figures

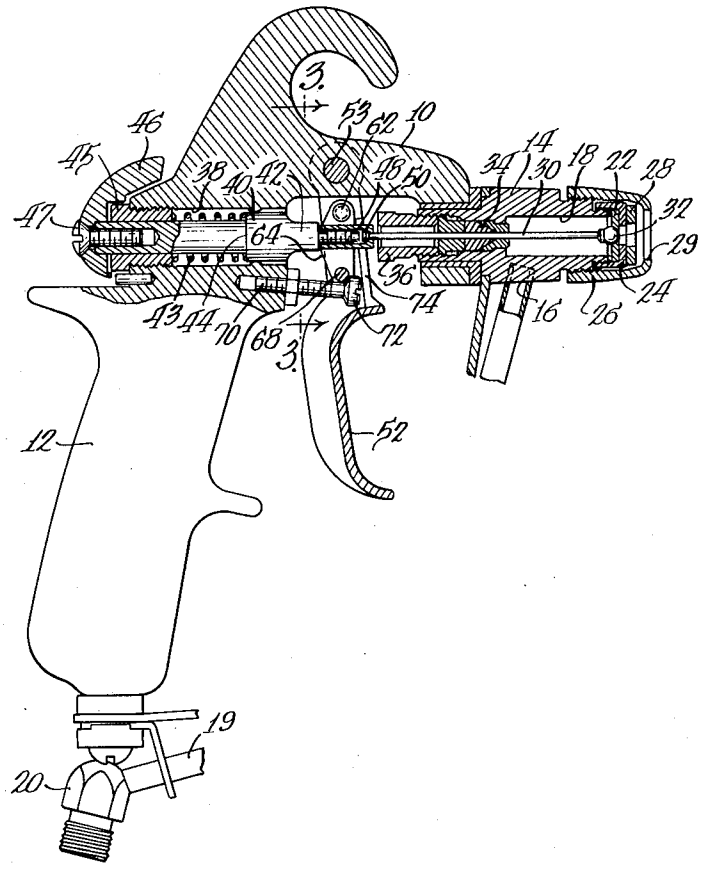


Fig. 1.

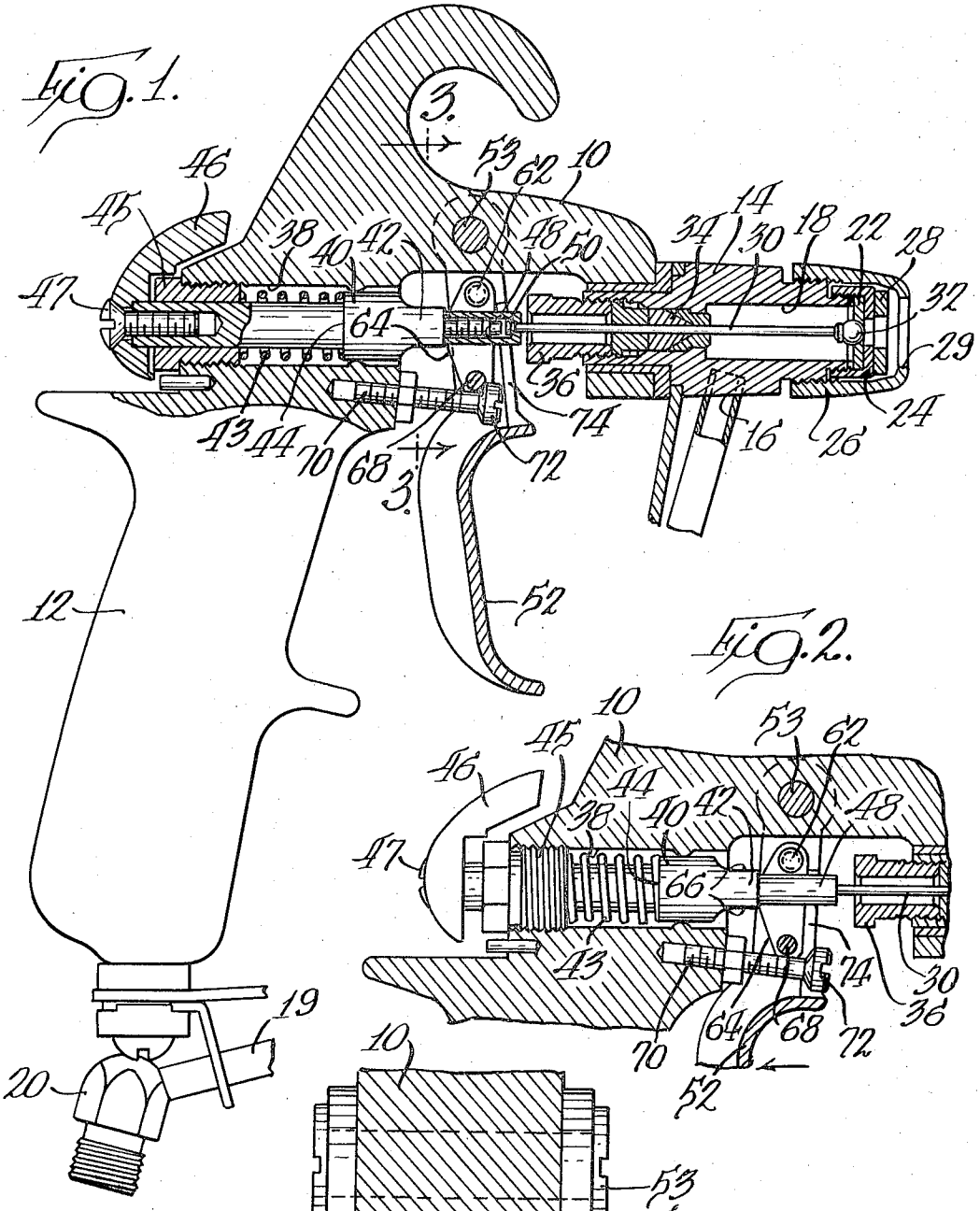
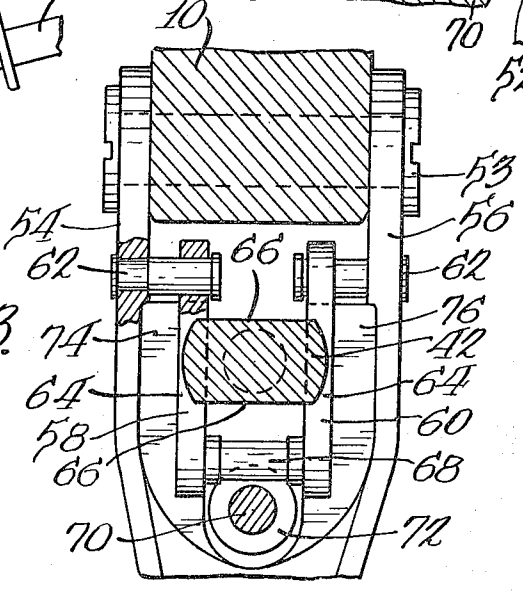


Fig. 2.

Fig. 3.



TRIGGER ASSEMBLY FOR A SPRAY GUN

BACKGROUND OF THE INVENTION

This invention relates to a trigger mechanism for opening a valve in a pressurized dispensing apparatus, and more particularly to an improvement imparting substantial mechanical advantage to the trigger in its initial movement as the valve is being opened against peak pressure in the gun.

In so-called "airless" or hydraulic spray guns, material is atomized by virtue of passage through a specially designed nozzle or spray tip under high fluid pressure, in the order of 1,000 psi or higher. Passage of the material to the nozzle is conventionally under control of a valve, and depending upon valve design, the fluid pressure in the gun acting upon the closed valve may have to be overcome before the valve can be opened. With relatively small valves and/or relatively low fluid pressures, the valve can be operated by a trigger pivotally mounted on the gun and connected to the valve stem. A conventional gun typically includes a body with a rigid handle, and a trigger pivotally connected at its upper end to the body and depending therefrom forwardly of the handle, so the operator can squeeze the trigger toward the handle and pull the valve open. A return spring is provided to return the valve and trigger to closed position upon release of the trigger.

The simple trigger mechanism above-described poses serious shortcomings in guns in which the fluid pressure acting against the closed valve is very high, i.e., wherein the combination of the area of the valve exposed to the fluid and the fluid pressure is such as to generate a large force holding the valve closed. This is especially true when the material to be sprayed is highly viscous or dense, because such material requires both a large size valve opening and high pressure. Airless guns for dispensing highly viscous or dense materials, such as mastic, require large internal passages, a large outlet valve and high fluid pressure, all of which combine to greatly increase the pressure on the closed valve and the force initially required to open the valve. Considerable extra force must be exerted on the valve initially to unseat the valve and permit pressure equalization around the valve. While a strong man might unseat the valve once or twice in a conventional application, he would quickly become fatigued and unable to operate the gun with the frequency of valve opening and closing movements conventionally required in spraying techniques.

SUMMARY OF THE INVENTION

The present invention overcomes the above problems by increasing the mechanical leverage of the trigger without increasing the dimensions of the trigger or of the gun. An intermediate portion of the trigger carries a lever which is pivotally connected at one end to the trigger and has an intermediate portion abutting the valve stem for opening the valve. The second end of the lever is free but engages a stop extending from the gun body, which prevents movement of that end in a direction opposite to that of the trigger, thereby to define a fulcrum for the lever.

As the trigger is squeezed, the lever is caused to swing about its fulcrum so that said intermediate portion is urged against the valve stem as a compound or double lever affording substantial mechanical advantage.

Thus, the valve is quite easily cracked open, so that the fluid pressure is equalized around the valve and this pressure is relieved or eliminated as a factor effecting valve movement. After the initial internal pressure has been overcome, by movement of the trigger through a short arc, conventional trigger action or "feel" is preferably restored. This is accomplished by causing a flange on the trigger to swing into engagement with the lever and move the lever conjointly with the trigger, whereby the trigger operates in a conventional manner relative to the valve and the valve spring.

A safety feature is provided by mounting that part of the valve stem which is engaged by the lever for rotary movement and so shaping said part that it may be rotated into and out of engagement with the lever, whereby the trigger and lever assembly may be rendered operative or inoperative at the operator's selection.

THE DRAWINGS

FIG. **1** is a side view, partly in elevation and partly in vertical section, of an airless spray gun incorporating the features of the present invention, the gun being shown with the valve thereof in closed position;

FIG. **2** is a fragmentary view of the gun, showing the valve thereof in a partly open position; and

FIG. **3** is a sectional view taken substantially on line **3—3** of FIG. **1.**

DESCRIPTION OF THE PREFERRED EMBODIMENT

The airless or hydraulic gun shown in FIG. **1** generally comprises a solid body **10** having a downwardly depending handle **12** at one end thereof and valved head assembly **14** at the other end. A material inlet **16** is connected to a longitudinal passage **18** within the head assembly, and said inlet may be connected by a pipe **19** to a remote inlet **20** at the base of the handle **12.**

An apertured valve seat **22** is secured at the forward end of the passage **18** by means of an internally threaded and apertured cap **24.** An internally threaded nozzle cap **26** is fitted over the end of the head assembly with a gasket **28** interposed therebetween, said nozzle cap having a central orifice **29** therein for reception of a spray tip (not shown) through which material is emitted under pressure when the valve is opened.

A rod or stem **30** is disposed axially in the passage **18** and has an enlarged round terminus or ball **32** at its forward end sealingly engageable with the apertured valve seat **22.** The other end of the rod **30** extends through a suitable gland assembly **34** at the rear end of the passage **18** adjacent the inlet **16,** said gland assembly including an adjustable pressure fitting **36.** The rod **30** is axially movable to open and close the valve, while the gland assembly **34** prevents leakage of pressurized material around the rod toward the rear at all times.

The rear portion of the body of the gun is provided with a cylindrical chamber **38** coaxial with passage **30,** and has a stem **40** slidably and rotatably disposed therein, the forward portion **42** of said stem extending forwardly toward the rod **30** and out of the body of the gun. A helical compression spring **43** is disposed between a retainer **45** in the rear of the gun and a shoulder **44** on the stem **40,** that portion of the stem coextensive with the spring being of reduced diameter. The

stem **40** extends rearwardly to the exterior of the gun through an opening in the retainer **45** and is connected by a screw **47** to a safety lock knob **46.**

The forward portion **42** of the stem **40** is threaded and receives an internally threaded collar **48** having a confined axial opening in the forward end which receives the rear end of the rod **30.** The rear end of rod **30** has a terminus **50** that is larger than the collar aperture, such that the rod is pulled by rearward movement of the collar and stem.

The stem **40** and associated rod **30** are moved rearwardly to open the valve by means of a trigger assembly including a main trigger **52** hinged at its upper end to the gun body at **53** and depending downwardly therefrom. Movement of the trigger assembly toward the handle **12** causes the stem **40** and rod **30** to move rearwardly, thereby moving the valve ball **32** away from the valve seat **22** to open the passage between the pressurized inlet **16** and the outlet **29** of the gun, as shown in FIG. **2.** When rearward pressure on the trigger **52** is released, the compression spring **43** urges the stem **40** and rod **30** forward to close the valve.

In the embodiment shown, the inlet **16,** passage **18,** valve seat **22** and valve ball **32** are relatively large to accommodate dispensing of relatively heavy or viscous materials, such as glue, mastic and similar materials. The material to be dispensed must be introduced under high pressure through the inlet **16** to achieve proper and continuous flow, and the pressure acting against the rearwardly exposed surfaces of the ball create a very considerable force holding the valve closed. In order to open the valve, a pulling force must be exerted on the rod **30** which is sufficient to overcome the internal pressure within the passage **18** acting on the surfaces of the ball **32** exposed to the fluid. Under these conditions, the use of a simple trigger to urge the stem **40** rearwardly does not provide sufficient leverage to facilitate opening of the valve. An operator may overcome the resistance to movement a few times but repeated closing and opening of the valve will quickly result in operator fatigue.

In accordance with the present invention, a compound lever arrangement is provided to assist the operator in effecting the initial stage of valve movement, i.e., during the first several degrees of movement of the trigger when the seal of the valve is broken. After the seal has been broken and the internal pressure equalized on the valve ball **32,** so that the only pressure to be overcome is that of the spring **43,** the load is gradually transferred solely to the trigger **52** as it continues to move rearwardly. The operator thereupon is afforded the normal or conventional "feel" of the trigger during spraying, but is materially assisted in getting the valve open.

As best shown in FIGS. **2** and **3,** the upper end of the trigger **52** is bifurcated to define respective arms **54** and **56** which straddle the gun body and extend downward with the rear edges of the arms approximately juxtaposed to the front end **42** of the stem **40.** A pair of levers or plates **58** and **60** (FIG. **3**) are pivotally connected at their upper ends by respective coaxial pins **62** to the respective arms **54** and **56** in parallel relationship, said plates each having arcuate rear edge surfaces **64** engageable in the direction of valve opening movement with the front face of the stem end **42.** The lower ends of the plates **58** and **60** are connected together by a pin **68,** such that the plates may swing together between the arms of the trigger on the common axis of their respective pivots **62.** The plates are thus mounted to be swingable in parallel vertical planes which are parallel to the axis of the rod **30.**

A stop in the form of a threaded lock bolt **70** having an enlarged head **72** extends generally forwardly from the gun handle **12** with the shoulder between the shank and the head of the bolt being engageable by the lower pin **68.** This bolt is adjustable to vary the portion of the trigger movement within which the plates **58–60** will operate as a separate lever, as will subsequently appear. The trigger has a pair of inwardly facing and opposed flanges **74** and **76** engageable with straight forward edge surfaces of the respective plates **58** and **60.** As shown in FIGS. **1** and **2,** respectively, said flanges and forward edge surfaces diverge downwardly away from one another when the trigger **52** is in the valve closed position, and engage flush against one another in the valve open position.

In order to open the valve, the trigger **52** is squeezed toward the handle. As the trigger moves rearwardly, the upper pivot pins **62** of the plate assembly **58–60** move rearwardly causing the arcuate rear edges **64** of the plates **58** to **60** to push rearwardly against the front face of the stem end **42** and the attached pin **68** to be urged forwardly into engagement with the fixed stop **72.** The stop **72** thus becomes the fulcrum and the pins **62** the point of force application to constitute the plates **58–60** a lever of the second class. Continued squeezing of the trigger causes rotation of the plates to the rear around the fulcrum formed by the stop so that the arcuate surfaces **64** move rearwardly relative to their initial position and urge the stem **40** rearwardly. Thus, the trigger **52** and the assembly of the plates **58** and **60** cooperate to form a compound lever and provide an initial force multiplier to facilitate initial opening of the valve.

In addition, the arcuate surfaces **64** of the lever assembly **58–60** ride up relative to their areas of engagement on the stem end **43** to serve as a cam further contributing to the force multiplication provided by the lever.

Thus, during the first few degrees of rearward arcuate movement of the trigger **52,** there exists a compound lever and cam action affording substantial mechanical advantage in getting the valve ball **32** off its seat **22.** The degrees of arcuate movement during which this condition exists is adjustable by virtue of adjustment of the stop **72.** All that is required is sufficient movement to crack the valve open, because fluid pressure will then equalize around the ball and the only resistance to further valve movement in the opening direction is that of the valve spring **43,** which is a conventional and accepted condition in the spray gun art. In fact, spray gun operators rely on this spring pressure to give them so-called trigger "feel" to aid in their spraying techniques. Consequently, once the valve ball is off its seat, it is desirable to return to a conventional trigger-valve relationship.

According to the invention, this is accomplished by so correlating the trigger to the lever assembly that there is a progressive decrease in the distance between the trigger flanges **74–76** and the forward surfaces of the plates **58–60,** so that the flanges eventually contact flush against the forward plate surfaces and restore the conventional trigger-valve relationship for continued rearward movement of the valve to full open position

as shown in FIG. **2.** When the trigger is released, the return spring **43** serves to return the trigger assembly and the valve to their original closed positions.

In summary, the trigger assembly includes a lever **58–60** of the second class which is disposed between the trigger **52,** the fixed stop **72** and the valve stem **40** to gain the extra mechanical advantage required to open the valve. After the initial internal pressure resistance has been overcome, the secondary lever is no longer required and becomes inoperative, with the force of the trigger being exerted directly on the valve stem. Because of the arrangement, the gun is easy to use and operator fatigue is eliminated.

Also, the structural assembly is such as to provide, conveniently and economically, a safety device for the operator's protection. Because of the high fluid pressure required to achieve atomization in airless spray guns, care must be exercised to insure that the material emanating from the gun does not strike anyone, as serious physical injury could be imposed. This is especially true of the operator. Thus, it is desired to render the trigger inoperative, i.e., either to lock it in closed position or to disconnect it from the valve stem, when the gun is not in active, supervised use. According to the invention this is accomplished by mounting the stem **40** for rotation by the external knob **46** and cutting away diametrically opposed portions **66** of the stem end **42** so that the stem can be rotated 90° between the operative position shown in FIG. **3** and an inoperative position wherein the stem end **42** is of a width less than the spacing between the lever plates **58–60** so that the plates clear the stem and cannot engage and move the same. Thus, in the inoperative position, the trigger hangs free and cannot operate the valve, whereby the operator may safely lay the gun down or hang it up during his rest periods and may clean the gun or change the spray tips without fear of inadvertently opening the valve and injuring himself.

What is claimed is:

1. In a trigger assembly for a spray gun having valve means held in closed position under fluid pressure, the improvement comprising a trigger pivotally connected to the spray gun, a lever pivotally connected to said trigger and having a portion engageable with said valve means, and stop means on the spray gun engageable by said lever for providing a fulcrum for said lever, said trigger being movable in valve opening direction to urge said lever against said valve means with compound leverage to move said valve means toward valve open position.

2. In the trigger assembly of claim **1,** said trigger being pivotally connected at its upper end to the gun and depending therefrom for rearward movement to open the valve means, said lever being pivotally connected at its upper end to said trigger and having a rearwardly protruding intermediate portion engageable with said valve means, said stop means being enageable with a forwardly facing portion of said lever at the lower end thereof whereby said lever comprises a lever of the second class.

3. In the trigger assembly of claim **2,** said trigger including a flange near the forward edge thereof spaced from said lever in valve closed position and engageable with said lever after predetermined movement in valve opening direction to cause said lever to move conjointly with said trigger.

4. In the assembly of claim **3,** said stop means having a head at the end thereof disposed forwardly of the lower end of said lever and engageable with said lever to define the fulcrum therefor, said stop means being adjustable to vary the degree of movement of said trigger prior to engagement of said flange with said lever.

5. In the assembly of claim **2,** said trigger being bifurcated at its upper end to form a pair of arms, said lever being mounted between said arms and comprising a pair of plates pivotally mounted at their upper ends in parallel on respective arms and a pin extending between and connecting the lower ends of said plates, said pin being engageable with said stop.

6. In the assembly of claim **5,** said valve means including a stem extending between said plates and a rotatable stem member having a first position in which forwardly facing surfaces thereof are juxtaposed to said plates and a second position wherein said surfaces are disposed between said plates, and means for rotating said stem member between said positions.

* * * * *