United States Patent [19]

Green

[11] **3,861,570**

[45] **Jan. 21, 1975**

[54] **VARIABLE SPRAY RATE AEROSOL VALVE CONSTRUCTION**

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[22] Filed: **May 11, 1973**

[21] Appl. No.: **359,230**

Related U.S. Application Data

[63] Continuation of Ser. No. 62,587, Aug. 10, 1970, abandoned.

[52] **U.S. Cl.**..... **222/402.17,** 222/402.24, 251/353

[51] **Int. Cl.**..... **B65d 83/14**

[58] **Field of Search**..... 222/402.1, 402.17, 402.14, 222/321, 383, 385, 402.24; 251/349, 351, 353, 354

[56] **References Cited**

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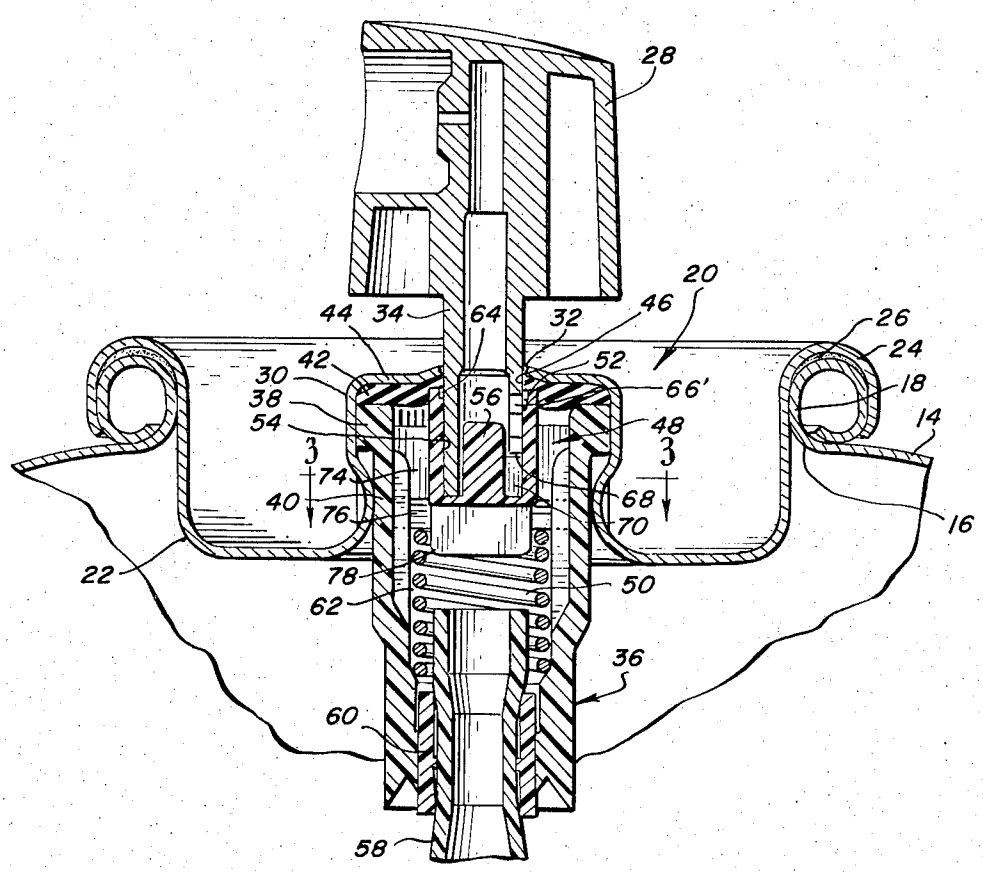
[57] **ABSTRACT**

A valve of the type which includes a removable sprayhead with a depending stem having a slot at the bottom end of the stem, the stem adapted to pass through an opening in a boss and through a passageway in an elastomeric gasket into the socket of a valve plunger, which in turn is mounted in a valve housing. The valve plunger has a plurality of axially elongate teeth on its periphery which cooperate with axially arranged ribs on the interior of the valve housing, so that during assembly the valve plunger will move into a position in the housing with the ribs engaged between teeth thereby providing a non-rotatable connection between the valve plunger and the housing. No special orientation of the valve plunger is needed during assembly because the teeth extend completely around the periphery of the plunger and are led into the valve housing.

8 Claims, 4 Drawing Figures



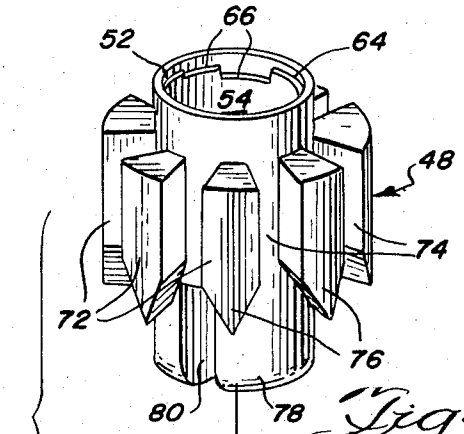


Fig. 4

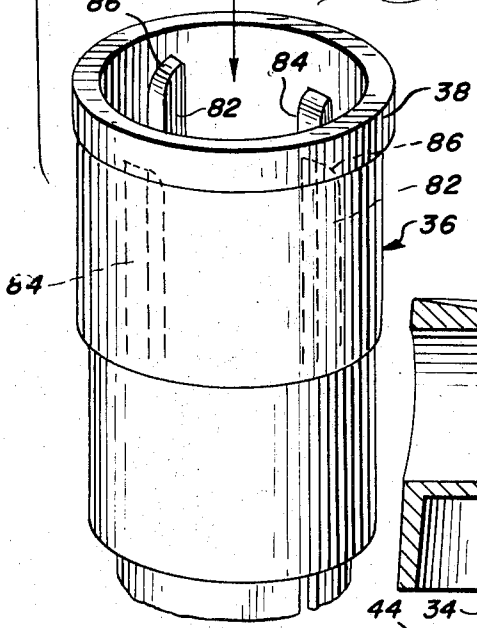


Fig. 3

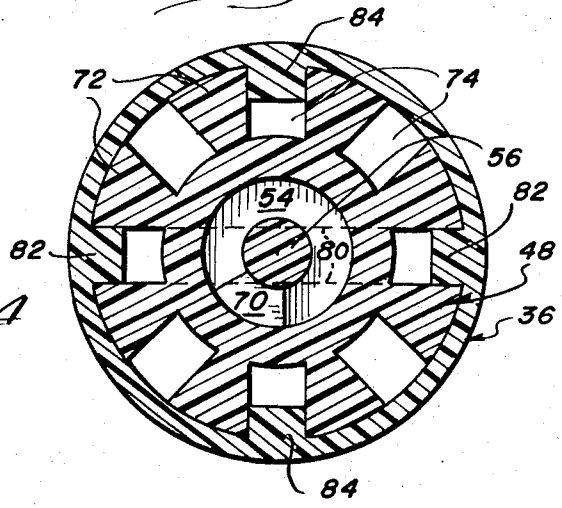


Fig. 1

Fig. 2

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VARIABLE SPRAY RATE AEROSOL VALVE CONSTRUCTION

This is a continuation of application Ser. No. 62,587, filed Aug. 10, 1970 now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is concerned generally with aerosol spray packages and more particularly is concerned with a novel valve construction for such packages.

The particular pressurized package spray apparatus with which the invention is concerned comprises a canister or bottle having an opening in the top thereof, and a cover member or closure mounting the sprayhead and valve structure being secured hermetically upon the said canister or bottle. The filler, that is, the manufacturer who will introduce the pressurized product into the canister or bottle, purchases the canisters or bottles from sources other than those from which he purchases the assembly of parts comprising the valve structure, sprayhead and cover member. The invention herein is concerned primarily with the valve structure, the sprayhead and cover member being known as will be explained below.

In this type of valve structure and sprayhead, there is a boss protruding from the center of the cover member upwardly, the boss having an opening, and there being a valve housing sealed to the bottom of the cover member and clamping a resilient, annular elastomeric gasket into the boss with the central passageway of the gasket aligned with the opening in the boss. A dip tube is secured to the bottom of the housing so that any pressurized product which emerges from the canister must pass through the housing, the central passageway and the opening in the boss. Within the housing there is a vertically reciprocable valve plunger which is urged upwardly against the bottom of the gasket by means of a spring which is held in the housing and bears against the bottom of the plunger. The upper end of the valve plunger has a valve seat surrounding a socket, both seat and socket being coaxially aligned with the passageway in the gasket. The sprayhead is an integral member having an enlarged button or spray tip adapted to be pressed downwardly by the finger of the user, and a depending hollow stem. The hollow bore of the stem communicates with an external orifice of the sprayhead, the said stem adapted to be slidingly and yet sealingly engaged through the gasket passageway and adapted to have its bottom end seated in the socket. With the sprayhead removed or left seated in the socket, there will be no pressurized product emerging from the canister due to the seating of the upper valve seat of the plunger against the bottom of the gasket. When the sprayhead is pushed downwardly, it unseats the valve seat of the plunger thereby enabling the pressurized product to rise in the dip tube, pass through the housing, pass over the valve seat into a slot formed in the lower end of the stem, enter the bore of the stem and pass through the external orifice of the sprayhead.

One version of the general structure described above had the socket symmetrical about its vertical axis and had the stem provided with a generally cylindrical or annular bottom end but for the axially extending slot. The benefits and advantages of this structure are known. A variation of this structure provided for variable spray rate by certain co-operating structure formed on the bottom end of the depending sprayhead

stem, the bottom end of the socket of the valve plunger and the upper walls of the socket as well. Instead of a cylindrical socket in the valve plunger coacting with the bottom end of the stem, the socket had stop means co-operating with a notch in the lower end of the stem to limit the amount of rotation of the sprayhead in the socket. In the previously described structure there were no such means, and the stem was free to rotate relative to the valve plunger, assuming that the plunger was not rotating with respect to the valve housing, which did not always occur. Additionally in the variation, along the upper edge of the valve plunger and in the socket there was a variable ramp or series of steps cutting into the wall from the interior thereof but not extending all the way through so that the upper end of the valve plunger could still function as a valve seat. The slot in the stem was of such length that when the bottom end of the stem was fully seated in the socket, the upper end of the slot extended slightly above the highest portion of the ramp or steps. Rotating the stem with respect to the valve plunger moved the slot to other locations where the opening out of the slot was of different area so that during use a variable spray rate could be obtained by choosing the part of the ramp or steps that was aligned with the slot. This was done by rotating the spray head slightly.

Another modified form of the construction described means to prevent the rotation of the valve plunger with respect to the valve housing. A pair of diametrically disposed ribs were formed in the interior of the valve housing, and the valve plunger has a lower flange with opposing notches. The notches were oriented during assembly to align with the ribs and the plunger and housing assembled in this condition.

The problem which arose occurred during manufacture of the latter structure. Machinery to assemble the parts was required to rotate the valve plunger properly to orient it relative to the ribs so that the plunger could telescopically move into the housing to enable the assembly to be completed. This required expensive apparatus and decreased the speed of assembly.

The invention obviates the problem which is described above.

2. The Prior Art

The basic valve structure which utilizes a simple slotted stem engaged in an annular socket and with no means to provide a variable spray or means to prevent rotation of the valve plunger with respect to the valve housing is disclosed in U.S. Pat. No. 2,777,735.

The valve construction which provides for variable spray but which has no means to prevent relative rotation of the valve plunger and the valve housing is disclosed in U.S. Pat. No. 3,188,008.

The valve construction which provides for variable spray and has the opposing ribs on the interior of the valve housing with the notched flange provided on the valve plunger is disclosed in U.S. Pat. No. 3,209,960.

SUMMARY OF THE INVENTION

According to the invention, the valve plunger is provided with a plurality of elongate teeth completely around its periphery. The lower ends of the teeth are tapered to chisel-like points, this being the end which enters into the valve housing. The valve housing has interior ribs, there being at least two and preferably four, the ribs including a diametrically opposed pair which extend substantially close to the upper end of the hous-

ing and have tapered or slanted formations to cooperate with the chisel points of the teeth. During assembly of the valve structure, the valve plunger need not be oriented, since at any rotational disposition, there will be a pair of opposing grooves formed between pairs of side-by-side teeth which will mesh with the ribs. The chisel points will be piloted by the tapered formations to turn the plunger sufficiently to cause the meshing.

Thus, the assembly of the valve structure requires only that the valve plunger be dropped into the valve housing without rotation, making such assembly simply and rapid.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an elevational view of an aerosol package showing the environment of the invention.

FIG. 2 is a fragmentary median sectional view taken through the valve and sprayhead of the aerosol package of FIG. 1 and in the direction indicated to illustrate the invention.

FIG. 3 is a sectional view taken through the valve construction of FIG. 2 along the line 3—3 and in the direction indicated, but with the stem not shown.

FIG. 4 is an exploded view of the valve plunger and valve housing to illustrate the manner in which they are assembled.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The aerosol package **10** of FIG. 1 comprises a canister **12** having a sealed bottom and a domed top **14** that terminates in an opening **16** having a rolled edge **18.** The valve structure **20** is mounted to a cover member **22** that has a rolled edge **24** that is crimped to the rolled edge **18** with a suitable sealing compound **26** therebetween. A sprayhead **28** protrudes from the top of the cover member and is adapted to be depressed to permit the pressurized product to be sprayed from the package **10.**

The cover member **22** has a central upstanding boss **30** that extends out of the center thereof, the boss **30** having a central opening **32** through which the depending stem **34** of the sprayhead **28** extends. There is a generally cylindrical valve housing **36** mounted to the cover member in fixed relationship and sealed relative thereto. The upper end of the housing **36** has an enlarged rim **38** that is crimped into the boss **30** by means of the crimps **40** so that the housing **36** is fully on the interior of the resulting assembly **20.** An elastomeric gasket **42** is sandwiched tightly between the rim **38** and the crown **44** of the boss **30.** The gasket **42** has a passageway **46** in its center which is aligned with the opening **32** and which slidingly but sealingly hugs the stem **34** of the sprayhead **28.**

On the interior of the valve housing there is a valve plunger **48** which is urged upwardly by the helical spring **50** seated in the bottom end of the housing **36.** The valve plunger **48** has a valve seat **52** formed on the upper end thereof, this seat being normally pressed into tight engagement with the gasket **42** to prevent any pressurized product from escaping. The valve plunger has a socket **54** to receive the lower end of the stem **34** therein, there being a pilot projection **56** in the center of the socket. There is a dip tube **58** clamped to the bottom of the valve housing **36** by means of a split ring **60** and serving to bring the pressurized product up into the chamber **62** from which it can be dispensed when the valve is opened. The particular structure which has been described has a gallery **64** formed on the interior of the valve plunger **48** at the upper end thereof, and the slot **66** opens into this gallery.

As thus far described, the apparatus is well-known. It functions as taught by said U.S. Pat. No. 2,777,735, with the sprayhead being removable as desired. Modifications of the apparatus to render the same a variable spray device is also known as taught in said U.S. Pat. Nos. 3,188,008 and 3,209,960. Thus, there are steps **66** in the wall of the valve plunger to cooperate with the upper end of the slot **66'** whereby to open the effective area of the slot to any of a plurality of different extents. This is augmented by the notch **68** and stop member **70** formed in the bottom of the socket **54.**

According to the invention, the valve plunger **48** is not provided with a lower flange as previously known, but instead has a plurality of axially extending teeth **72** integral therewith, these teeth being spaced around the periphery of the plunger and providing grooves **74** between adjacent pairs. Any suitable number of teeth may be used, providing that they extend fully around the periphery and are dimensioned and arranged to cooperate with the ribs to be described. The lower ends of the teeth **72** are provided with chisel points **76** and there is a lower extension **78** that is adapted to engage in the spring **50** to seat the plunger. The extension **78** is split at **80** to assist in providing for free flow of pressurized product during use.

On its interior, the valve housing **36** is provided with two pairs of elongate ribs **82** and **84,** the ribs of each pair being diametrically opposite one another. The ribs **82** and **84** are axially aligned and the placement of them is such that they will mate with any four of the grooves **74** that are spaced 90° about the periphery of the valve plunger **48.** As will be noted, there is a total of eight teeth **72** which provide eight grooves **74** between them, the grooves being spaced 45° apart. The teeth and grooves are symmetrical, so that any rotary disposition of the plunger **48** will move it into engagement with the four ribs **82** and **84.**

Preferably at least one pair of ribs **82** will be longer than the others, extending quite close to the top end of the housing **36** so that when the plunger **48** is moved into the interior of the housing, these ribs **82** will be engaged first. The upper ends of these ribs are shown slanted at **86** so that when the chisel points **76** engage the same, there will be a piloting action in which the points **76** are rotated slightly while following down the slants **86** to lead the plunger into mating engagement with all of the ribs **82** and **84.** This final engagement is best shown in FIG. **3** and will be noted that in the case of an eight tooth valve plunger cooperating with a four rib housing, there are four of the grooves **74** which are totally unblocked so that pressurized product freely passes up through the same.

It will be appreciated that the drawing illustrates the parts on a greatly enlarged scale. The outer diameter of the valve plunger **48** is approximately one quater of an inch. Thus the roots of the teeth **72** are quite fine and might be considered weak and liable to be broken by the user during manipulation of the sprayhead. The use of four ribs **82** and **84** provides the strength of four teeth to oppose any pressure applied by the user in rotating the sprayhead **28.**

The principal advantages of the invention accrue during the assembly of the valve structure **20.** Modifi-

cations may be made to secure these advantages without departing from the spirit or scope of the invention as defined in the appended claims. For example, the teeth might be formed on the interior of the housing, and the lesser ribs formed on the exterior of the valve plunger. No limitations are intended by referring to the structure **72** as teeth, the structure **74** as grooves and the structure **82** and **84** as ribs. The ribs could be considered as keys and the grooves **74** as slots.

What it is desired to secure by Letters Patent of the United States is:

1. An aerosol valve and removable sprayhead structure in which the valve structure includes a valve housing with a dip tube adapted to bring pressurized product to the interior of said housing, a spring pressed valve plunger reciprocable in said housing, means forming a socket in the plunger opening to the top thereof and an annular valve seat about the said top of the socket, a resilient gasket secured in said cover member with said housing and having a central passageway, a central opening in the cover member, said socket, opening and passageway being coaxially aligned, the removable sprayhead includes a depending hollow stem having an axial slot in a wall thereof opening to the bottom end of said stem and the said stem extending through the passageway and central opening in a sealed but rotative and slidable engagement and having the said bottom end seated in said socket with the top end of the slot opening out of the socket, and in which there is a slot and key connection between said housing and plunger permitting reciprocation of the plunger within the housing while preventing rotation of the plunger relative to the housing wherein said stem can be rotated to different positions relative to said valve plunger to provide different spray rates at each position; and means to facilitate assembly of the plunger and housing during manufacture of said valve structure and including a plurality of more than two axially aligned elongated teeth, the lower ends of which are tapered to chisel-like points, said teeth equally circumferentially spaced completely around one of the exterior of the plunger and interior of the housing, providing a plurality of grooves between adjacent pairs of teeth and at least a pair of diametrically opposite, axially aligned, circumferentially spaced ribs on the other of said exterior of the plunger and interior of the housing, the ribs being axially aligned such that they will mate with said grooves, the upper ends of the ribs are slanted and form radially aligned edges, the number of ribs being less than the number of teeth whereby there will be a plurality of unoccupied spaces between pairs of teeth after assembly, the lower ends of the teeth and the upper slanted ends of the ribs providing piloting means for alignment of the plunger and housing when the plunger is moved into the housing.

2. The structure as claimed in claim **1** in which the ribs are on the interior of the housing and the teeth on the exterior of the plunger.

3. The structure as claimed in claim **1** in which the lower end of the plunger has an extension whose diameter is substantially less than the remainder of said plunger and the housing has a helical spring in the bottom thereof, the extension being adapted to engage and seat in the spring during assembly of the plunger and housing.

4. The structure as claimed in claim **1** in which there are four ribs spaced 90° apart and there are eight teeth.

5. The structure as claimed in claim **4** in which only one diametrically opposed pair of ribs has the upper ends slanted and said pair is longer than the other pair.

6. The method of assembling the aerosol valve structure of claim **1** in which the valve structure includes means to facilitate assembly of the plunger and housing during manufacture of said structure and including a plurality of more than two axially aligned elongated teeth the lower ends of which are tapered to chisel-like points, said teeth equally circumferentially spaced completely around one of the exterior of the plunger and interior of the housing, providing a plurality of grooves between adjacent pairs of teeth, and at least a pair of diametrically opposite axially aligned, circumferentially spaced ribs on the other of said exterior of the plunger and interior of the housing, the ribs being axially aligned such that they will mate with said grooves, the upper ends of said ribs are slanted and form radially aligned edges, the number of said ribs being less than the number of teeth whereby there is a plurality of unoccupied spaces between pairs of teeth after assembly, the lower ends of the chisel-like points of the teeth and the upper slanted ends of the ribs providing piloting means for the movement of the teeth relative the ribs during assembly such that the ribs and teeth are aligned in the housing during assembly, said method comprising moving said plunger into the top of said housing.

7. An aerosol valve and removable sprayhead structure in which the valve structure includes a valve housing with a dip tube adapted to bring pressurized product to the interior of said housing, a spring pressed valve plunger reciprocable in said housing, means forming a socket in the plunger opening to the top thereof and an annular valve seat about the said top of the socket, a resilient gasket secured in said cover member with said housing and having a central passageway, a central opening in the cover member, said socket, opening and passageway being coaxially aligned, the removable sprayhead includes a depending hollow stem having an axial slot in a wall thereof opening to the bottom end of said stem and the said stem extending through the passageway and central opening in a sealed but rotative and slidable engagement and having the said bottom end seated in said socket with the top end of the slot opening out of the socket, wherein said stem can be rotated to different positions relative to said valve plunger to provide different spray rates at each position and in which there is a slot and key connection between said housing and plunger permitting reciprocation of the plunger within the housing while preventing rotation of the plunger relative to the housing; and means to facilitate assembly of the plunger and housing during manufacture of said structure and including a plurality of more than two axially elongated teeth the lower ends of which are tapered to chisel-like points, said teeth equally circumferentially spaced completely around one of the exterior of the plunger and interior of the housing, providing a plurality of grooves between adjacent pairs of teeth, and at least two pairs of diametrically opposite, axially aligned, circumferentially spaced ribs on the other of said exterior of the plunger and interior of the housing, the ribs being axially aligned such that they will mate with said grooves, the upper ends of said ribs are slanted and form radially aligned edges, only one diametrically opposed pair of ribs has the upper ends slanted and is

longer than the other pair, the number of said ribs being less than the number of grooves formed by the pairs of teeth whereby there is a plurality of unoccupied spaces between pairs of teeth after assembly, the lower ends of the chisel-like points of the teeth and the upper slanted ends of the longer pair of ribs forming piloting means for the alignment of the plunger and housing when the plunger is moved into the housing.

8. A variable spray aerosol apparatus in which there is a cover member adapted to be mounted on a canister, a valve structure and removable sprayhead secured to said cover member to control the dispensing of pressurized product to be introduced in said canister, in which the valve structure includes a valve housing with a dip tube adapted to bring pressurized product to the interior of said housing, a spring pressed valve plunger reciprocable in said housing, means forming a socket in the plunger opening to the top thereof and an annular valve seat about the said top of the socket, a resilient gasket secured in said cover member with said housing and having a central passageway, a central opening in the cover member, said socket, opening and passageway being coaxially aligned, the removable sprayhead includes a depending hollow stem having an axial slot in a wall thereof opening to the bottom end of said stem and the said stem extending through the passageway and central opening in a sealed but rotative and slidable engagement and having the said bottom end seated in said socket with the top end of the slot opening out of the socket, said stem being rotatable to different positions relative to the valve plunger to provide different spray rates at each position, there being a slot and key connection between said housing and plunger permitting reciprocation of the plunger within the housing while preventing rotation of the plunger relative to the housing; said slot and key connection consisting essentially of eight axially aligned elongated teeth the lower ends of which are tapered to chisel-like points, said teeth equally circumferentially spaced completely around the exterior of the plunger, providing eight grooves equally spaced 45° apart between adjacent pairs of teeth and two pairs of diametrically opposite, axially aligned, circumferentially spaced ribs of about equal thickness 90° apart on the interior of the housing, said ribs forming there between spaces of about equal depth and cross-sectional area, the ribs being axially aligned such that they will mate with said grooves, the upper ends of said ribs are slanted and form radially aligned edges, only one diametrically opposed pair of ribs has the upper ends slanted and is longer than the other pair, the four ribs being less in number than the eight grooves formed by the pairs of teeth whereby there are four unoccupied spaces of about equal cross-sectional area between pairs of teeth after assembly, the lower ends of the chisel-like points of the teeth and the upper slanted ends of the longer pair of ribs forming piloting means for the movement of the teeth relative the ribs during assembly so as to cause alignment of the plunger and housing when the plunger is moved into the housing.

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