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E. T. GEORGE ET AL

3,293,749

AMALGAM GUN

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2 Sheets-Sheet 1

Fig. 1.

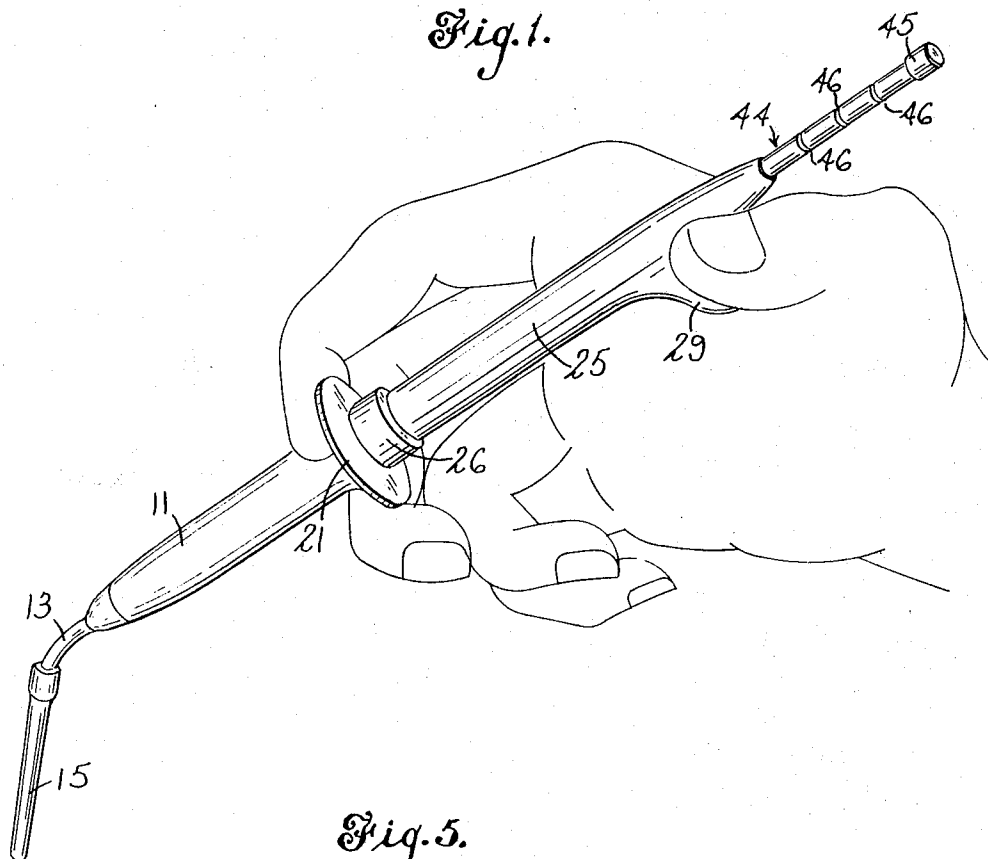
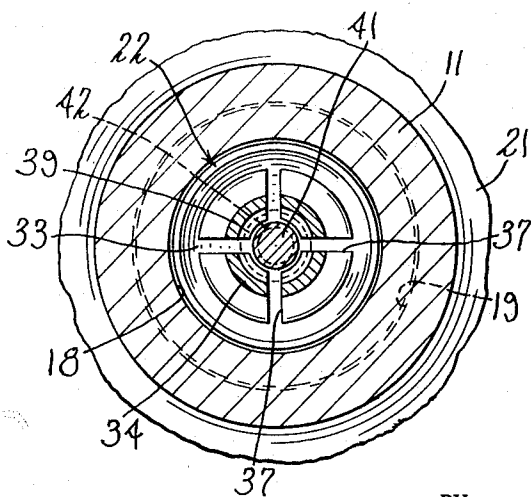


Fig. 5.



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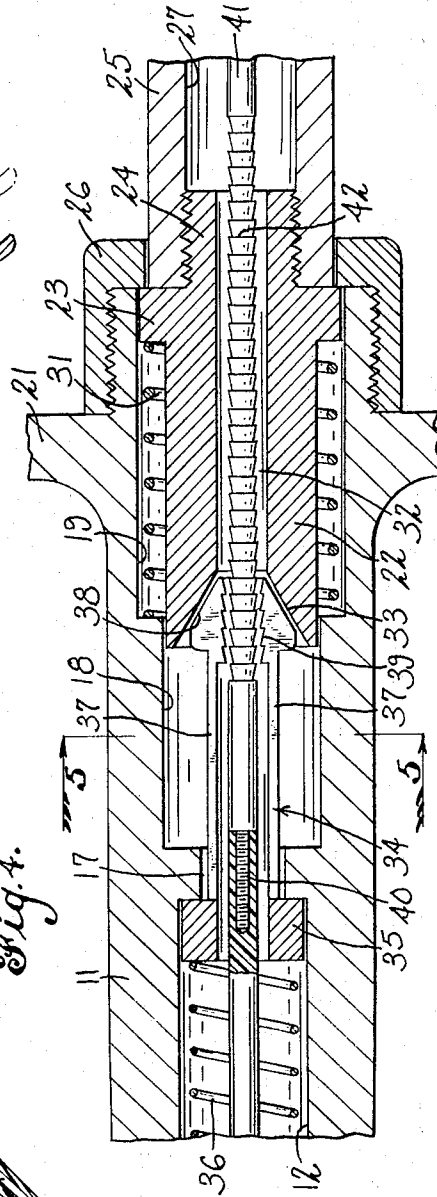
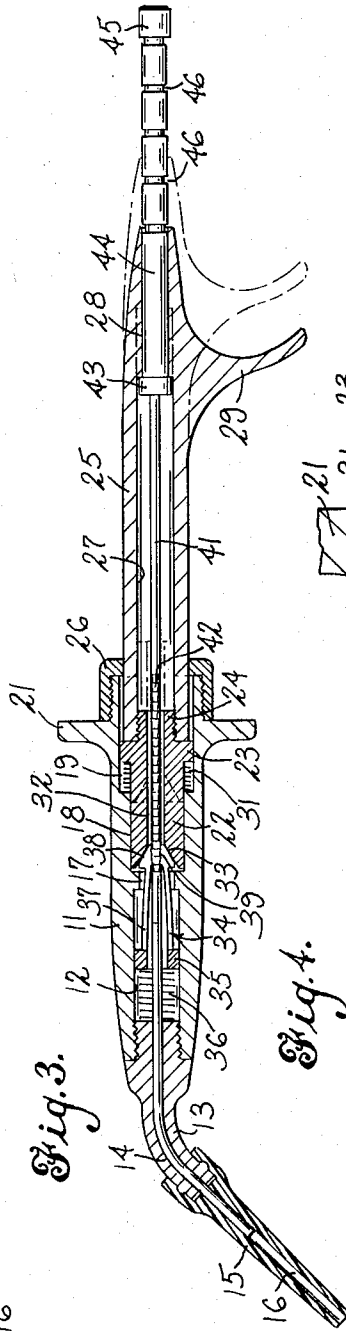
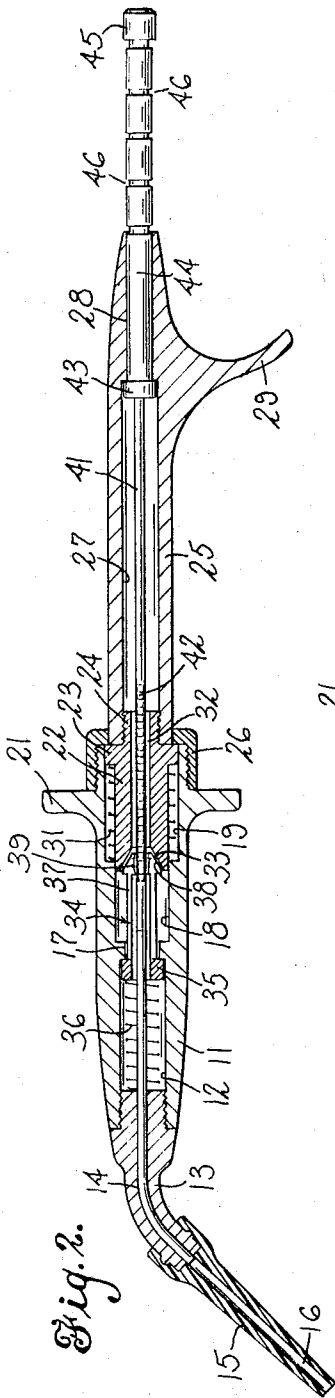
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AMALGAM GUN

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6 Claims. (Cl. 32—60)

This invention relates generally to an amalgam gun of the type used by dentists and is more specifically directed to an improved amalgam gun which accommodates a large quantity of amalgam and which is provided with means for expelling selected quantities of amalgam on consecutive strokes until the entire contents of the gun are expelled. Amalgam is an alloy of mercury with another metal or metals and silver amalgam is used extensively for dental fillings.

The amalgam is mixed by the dentist or his assistant immediately prior to filling of a cavity, after the cavity has been prepared. A standard measure of amalgam has become known as a "spill" and, depending upon the size of the cavity to be filled, a batch consisting of one or two spills of amalgam will usually be mixed. A gun or tool is used to transfer the amalgam into the cavity. Once in place, the amalgam is packed and carved by means of various tools common in the dental profession. Only a small quantity of amalgam is placed in the cavity at any one time so that the dentist may continually pack the filling to assure a uniform density throughout. The standard amalgam gun widely used by dentists picks up only a small quantity of amalgam for insertion in the cavity. After the amalgam has been expelled into the cavity, the gun must again be filled by hand by tamping the opening at the end of the gun into the prepared amalgam. This forces a quantity of amalgam up into the gun tip from which it is expelled into the cavity. The filling of the standard gun is a time-consuming operation and is an operation that takes place continuously while the dentist is filling the cavity. If a large quantity of amalgam is placed in the cavity, it may be necessary for the dentist to refill the gun as many as ten times during the filling operation. In addition to being time-consuming, this leaves the amalgam exposed to the air which causes it to partially harden before it is inserted into the cavity. This is undesirable as filling layers may be formed which may eventually cause failure of the filling. As can readily be seen, an amalgam gun which can accommodate the entire quantity of amalgam is a substantial improvement over the standard gun. Such a gun is known in the art. However, guns developed in the past have been bulky, unnecessarily complex, difficult to clean, poorly calibrated and expensive to fabricate.

Accordingly, it is an object of this invention to provide an improved amalgam gun capable of holding large quantities of amalgam and expelling a predetermined quantity each time the gun is operated.

Another object of the invention is to provide an improved amalgam gun of such a construction that positive displacement of amalgam is assured each time the gun is operated.

A further object of the invention is to provide an amalgam gun having an improved amalgam-expelling mechanism.

Still another object of the invention is to provide an improved amalgam gun which may be readily disassembled for cleaning.

Still other objects and advantages of the invention will in part be obvious and will in part be apparent from the specification.

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Generally speaking, in accordance with the invention, the preferred embodiment of the amalgam gun consists of a body which slidably receives a trigger barrel. A central plunger extends through the body and trigger barrel and into a tip which is sufficiently large to receive a large quantity of amalgam. A collet encircling the plunger is slidably mounted within the body, the collet being adapted to move the plunger when the collet is compressed about the plunger. A compressing collar is carried by the trigger barrel in such a manner that forward movement of the trigger barrel compresses the collet and positively drives the plunger to expel a predetermined amount of amalgam. When the trigger barrel is released for rearward movement, the return spring is so selected that the compression collar releases the collet before the collet returns to its original position, so that a return action will not be imparted to the plunger. In this manner, the end of the plunger remains in contact with the amalgam in the tip thereby eliminating lost motion when the plunger is again advanced.

The invention accordingly comprises the features of construction, the combination of elements and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the invention, reference is had to the following description taken in connection with the accompanying drawings, in which:

FIG. 1 is a perspective view of an amalgam gun constructed in accordance with the invention, shown in the operative position as it might be held by the hand of a dentist;

FIG. 2 is a sectional elevational view of an amalgam gun constructed in accordance with the invention and shown in the rest, unloaded position;

FIG. 3 is a view similar to FIG. 2, showing the trigger barrel in an amalgam-expelling position;

FIG. 4 is a partial sectional view of the device as shown in FIG. 2, with the operating parts being shown at an enlarged scale; and

FIG. 5 is a sectional view taken along line 5—5 of FIG. 4.

Referring now to the drawings, an elongated body 11, having a substantially circular cross-section, is provided with a plurality of cylindrical bores extending therethrough from end to end. A first bore 12 extends into the body from the forward end thereof, with the leading portion of the first bore being threaded to threadedly receive a neck 13 having an aperture 14 therethrough which communicates with first bore 12. A removable tip 15 having an amalgam-storing passage 16 therethrough is mounted on neck 13. From the internal end of first bore 12 extends a short second bore 17 of reduced diameter which communicates with a larger third bore 18 whose diameter may be slightly larger than the diameter of first bore 12. A fourth bore 19 of greater diameter communicates between third bore 18 and the other or rearward end of body 11. Intermediate its ends, body 11 is provided with a circular projection 21 which provides a gripping surface as will become hereafter apparent.

A cylindrical sleeve 22 is slidably mounted within third bore 18 for longitudinal movement with respect to the body. The rearward end of sleeve 22 is provided with an annular projecting collar 23 whose outside diameter is slightly smaller than the inside diameter of fourth bore 19. Thus, as sleeve 22 slides within the walls of third bore 18, the projecting collar portion thereof slides within the walls of fourth bore 19. Sleeve 22 is provided with a projecting rearward end 24 whose external surface is threaded for engagement with a trigger barrel 25. The external cylindrical size of trigger barrel 25

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is slightly smaller than the outside diameter of annular projecting collar 23 and a threaded collar 26 passes over the trigger barrel and threadedly engages the rearward end portion of body 11. In this manner, when the trigger barrel is threaded to sleeve 22 and collar 26 is threaded to body 11, the trigger barrel will not become detached from the body.

Trigger barrel 25 is provided with an elongated cylindrical fifth bore 27 which communicates with a slightly smaller sixth cylindrical bore 28 extending through the rear end of the trigger barrel. A trigger projection 29 extending from the trigger barrel aids in gripping and operating the device. A compression spring 31 encircles sleeve 22 within fourth bore 19 and acts between the body and annular projecting collar 23 to urge the trigger barrel away from the body. A circular passage 32 extending through sleeve 22 along the central axis thereof, merges at the forward end of the collar, with a cone-shaped opening 33 forming a cam surface whose use will be hereafter described. A tube 34 is slidably mounted within body 11 through second aperture 17, the tube being provided with a forward end 35 of greater diameter which slidably rides within first bore 12. A compression spring 36 within the first bore acts between the inner end of neck 13 and forward end 35 to urge tube 34 toward the right, as viewed in FIGS. 2 and 3. The rearward portion of tube 34 carries longitudinal slots 37 to permit deflection of the segments thereby defined. The rearmost end of tube 34 is headed and provided with a sloping exterior surface 38 adapted to mate with cone-shaped opening 33 in sleeve 22. Tube 34 is, in effect, a collet of the type known in the chucking art. The interior surface of tube or collet 34 in the area of sloping surface 38 at the rearward end of the collet, is provided with a plurality of teeth 39 whose use will be hereafter described.

A plunger 41 is slidably mounted through neck 13, through the body, through collet 34, through sleeve 22 and through the trigger barrel. If desired, plunger 41 may be constructed as two pieces with the forward end being fabricated from a flexible material such as nylon, so that it may readily flex and slide through neck 13. The portion of plunger 41 passing through the collet and sleeve may preferably be fabricated of stainless steel for rigidity and long life. The nylon portion could be threaded into the steel portion as indicated at 40. In any event, the central portion of plunger 41 is provided with a plurality of teeth 42 which are adapted to mate with the teeth 39 on the collet. As best shown in FIG. 4, the teeth slope inwardly to provide a ratchet action in cooperation with the mating teeth on the collet. The rear end of plunger 41 is secured to a cylindrical block 43 slidably mounted within fifth bore 27. Secured to block 43 at the other side thereof, is a shaft 44 slidably mounted within sixth bore 28 and extending beyond the rearward end of trigger barrel 25. The outermost end of shaft 44 may be provided with a knurled knob 45 for ease of gripping and the visible portions of shaft 44 will preferably be divided or marked with suitable indicia 46 to provide measurement or calibration of the amount of amalgam expelled from the tip.

The operation of the amalgam gun may now be described. The empty, rest position of the device is shown in FIG. 2. Spring 36 urges collet 34 to the right while spring 31 urges sleeve 22 and the trigger barrel to the right. When both the collet and collar are thus retracted the maximum amount, the cam surface of cone-shaped opening 33 is out of contact with the mating surface on the collet thereby permitting the normal resiliency of the collet to move its teeth out of contact with the teeth on the plunger. The plunger may then be physically grasped by means of knob 45 and withdrawn to the right the maximum amount until block 43 strikes the surface defining the intersection between fifth bore 27 and sixth bore 28. The block thereby forms a stop to prevent

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full withdrawal of the plunger. The gun is now in position to receive a supply of amalgam.

A batch of amalgam is prepared and packed into the passage in tip 15. This may be done by means of known methods, by continually pressing or tamping the end of the tip into the batch of amalgam to force the amalgam up into the tip passage. Alternatively, tip 15 may be removed and filled with the amalgam and thereafter replaced on neck 13. It is contemplated that the tip could be provided with a storage chamber or funnel opening at the upper end to provide for ease of insertion of the amalgam. However, since the design of the tip forms no part of the instant invention, only one type of tip is shown. Once the tip passage is completely filled with amalgam, the dentist is ready to commence filling the cavity and further delay will not be encountered in filling the amalgam gun. A prototype of the gun which has been constructed is capable of accommodating two full spills of amalgam. This quantity is approximately ten times the capacity of the standard gun, thereby equating a single filling of the instant gun to ten fillings of the standard gun. Of course, it will be understood that no limitation on size or amalgam volume of the gun is intended.

The gun is gripped by the dentist as shown in FIG. 1. The fore and middle fingers hold the body in engagement with the leading side of projection 21 while the thumb engages trigger projection 29. By applying a squeezing pressure, trigger barrel 25 is moved toward the left (FIG. 2) relative to body 11. For expelling the first quantity of amalgam, positive drive is provided by engagement of the trigger barrel with block 43. This advances plunger 41 thereby expelling amalgam at the tip. The positive drive for expelling an initial quantity of amalgam is advantageous for the reason that the amalgam at the edge of the tip may have hardened or set slightly while the dentist was making final preparations. As the trigger barrel advances, sleeve 22 also advances relative to body 11 and cam surface 33 moves into engagement with the sloping surface on collet 34. This effects an inward deflection of the collet as shown in FIG. 3 thereby causing the teeth on the collet to engage teeth 42 on the plunger. Once the teeth are in engagement, further advance of sleeve 22 causes the collet to advance and pull the plunger with it. The fully advanced position of the sleeve and collet is shown in FIG. 3. The stop or fully advanced position may be designed so that a full single stroke expels the same quantity of amalgam as the standard gun.

When the dentist releases pressure from the gun, spring 31 immediately acts on sleeve 22 to return the collar and trigger barrel to the rest position. Spring 31 is so designed with respect to spring 36 that greater pressure is applied by spring 31 to assure movement of sleeve 22 before collet 34 is returned to its rest position. The initial return motion of sleeve 22 moves cam surface 33 out of contact with sloping surface 38 on the collet thereby permitting the collet to expand and release the teeth on the plunger. In this manner, collet 34 returns to the FIG. 2 position without retracting the plunger. In other words, at the completion of a cycle of operation, the plunger remains in its advanced position in contact with the amalgam in the tip. Thus, on a subsequent stroke of the gun, no lost motion is required.

Referring specifically to FIG. 3, trigger barrel 25 is shown in the advanced position in full lines and in the retracted or rest position in phantom lines. However, it will be noted that shaft 44 and plunger 41 remain in the advanced position so that the indicia on the shaft are now partially within the trigger barrel. In this manner, the dentist can visually determine the quantity of amalgam expelled and the quantity remaining. On each subsequent stroke of the trigger barrel, sleeve 22 moves into engagement with collar 34, thereby causing the teeth on the collet to grip teeth on the plunger and advance the

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plunger with the further advancement of the trigger barrel. When the pressure is released, sleeve 22 initially releases the collet so that both the collet and sleeve return to the rest position without causing withdrawal of the plunger. When the entire quantity of amalgam has been expelled, the plunger is manually withdrawn by gripping knob 45. The plunger may be manually withdrawn so long as the trigger barrel is in the retracted position, thereby assuring that the collet will have released the plunger.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above construction without departing from the spirit and scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

What is claimed is:

1. An amalgam gun comprising a tubular body, a tip mounted on the forward end thereof for delivery of amalgam therefrom, a tubular trigger barrel having a portion thereof slidably mounted within said body from the rearward end of said body, a sleeve secured to said trigger barrel within said body, a collet slidably mounted within said body, the rearward end of said collet adapted to mate with the forward end of said sleeve, said collet being provided with a plurality of circumferentially spaced, inwardly extending teeth adapted to be inwardly deflected during engagement of said collet with said sleeve, and a plunger slidably mounted through said body, said trigger barrel, said sleeve and said collet and extending into said tip, said plunger being provided with a plurality of outwardly extending teeth along a portion of the peripheral surface thereof, said teeth adapted to be engaged by the teeth on said collet during inward deflection thereof, whereby forward movement of said trigger barrel causes engagement of said sleeve with said collet effecting a gripping of said plunger by said collet through the mating teeth to effect forward movement of said plunger during forward movement of said trigger barrel and whereby rearward movement of said trigger barrel effects a release of said collet to permit rearward movement of said trigger barrel and collet without affecting the position of said plunger.

2. The structure defined in claim 1 and further including first resilient means acting between said body and said collet to urge said collet in a rearward direction and second resilient means acting between said body and said sleeve to urge said sleeve in a rearward direction, the forces applied by said second resilient means being sufficiently greater than the forces applied by said first resilient means to provide a more rapid return action of said sleeve when said trigger barrel is released than is imparted to said collar, whereby, upon release of said trigger barrel, said sleeve moves out of contact with said collet to permit said collet to release its gripping action of said plunger before said collet is moved in a rearward direction by said first resilient means.

3. The structure defined in claim 1 wherein said plunger extends beyond the rearward end of said trigger barrel and further including visible indicia on the outwardly extending portion of said plunger cooperating with the rearmost portion of said trigger barrel for indicating the quantity of amalgam remaining in the gun.

4. The structure defined in claim 1 and further including a block secured to said plunger and slidably mounted within said trigger barrel and a projection within said trigger barrel adapted to be abutted by said block when said plunger is in the fully retracted position, whereby the initial forward action of said trigger barrel positively

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drives said plunger by engagement of said projection with said block.

5. An amalgam gun comprising a tubular body having a first bore of a first diameter extending partially into said body from the forward end thereof, a second bore of a larger diameter extending wholly within said body from the terminus of said first bore, and a third bore of larger diameter than the second bore extending from the terminus of said second bore through the rearward end of said body, a tip mounted on the forward end of said body and having a passage therethrough communicating with said first bore, a tubular trigger barrel having a portion thereof slidably mounted within said third bore, said trigger barrel having a bore passing therethrough from end to end, a sleeve secured to the forward end of said trigger barrel, said sleeve being slidably mounted within said second bore and having an annular projecting lip slidably mounted within said third bore, the forward end of said sleeve defining a cone-shaped opening therein, a collet slidably mounted within said first bore and having a portion thereof extending into said second bore, the rearmost peripheral edge of said collet being tapered to mate with the cone-shaped opening in the forward end of said sleeve, said collet having a central bore therethrough and radially-directed, longitudinal slits to permit inward deflection of the tapered end of said collet when pressure is applied to said collet by cooperation of the tapered surface thereof with the cone-shaped opening in said sleeve, said collet being provided with a plurality of circumferentially-spaced, inwardly extending teeth at the rearward end thereof, a plunger slidably mounted through said body, said trigger barrel, said sleeve and said collet and extending into said tip, said plunger being provided with a plurality of outwardly extending teeth along a portion of the peripheral surface thereof, said teeth adapted to be engaged by the teeth on said collet during inward deflection of the rearward end thereof, a first spring encircling said plunger within said first bore and acting between said body and said collet to urge said collet in a rearward direction, and a second spring encircling said sleeve within said third bore and acting between said body and the annular projecting lip of said sleeve to urge said sleeve in a rearward direction, the forces exerted by said second spring being sufficiently greater than the forces exerted by said first spring to provide for more rapid rearward movement of said sleeve than said collet when said trigger barrel is released subsequent to an advance stroke.

6. The structure defined in claim 5 wherein the bore through said trigger barrel includes a first section of smaller diameter extending into the barrel from the forward end thereof and a shorter second section of larger diameter extending into the barrel from the rear end thereof, said sections defining an annular wall at the plane of communication thereof and further including a cylindrical block secured to said plunger and slidably mounted within said first section, said block adapted to engage said annular surface to thereby define the fully retracted position of said plunger.

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