United States Patent

Termet

[15] **3,686,858**

[45] **Aug. 29, 1972**

[54] **CARTRIDGE ACTUATED TWO PART RAM**

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[52] **U.S. Cl.**.....**60/26.1**
[51] **Int. Cl.**.....**F01b 29/08**
[58] **Field of Search**.....60/26.1

[56] **References Cited**

UNITED STATES PATENTS

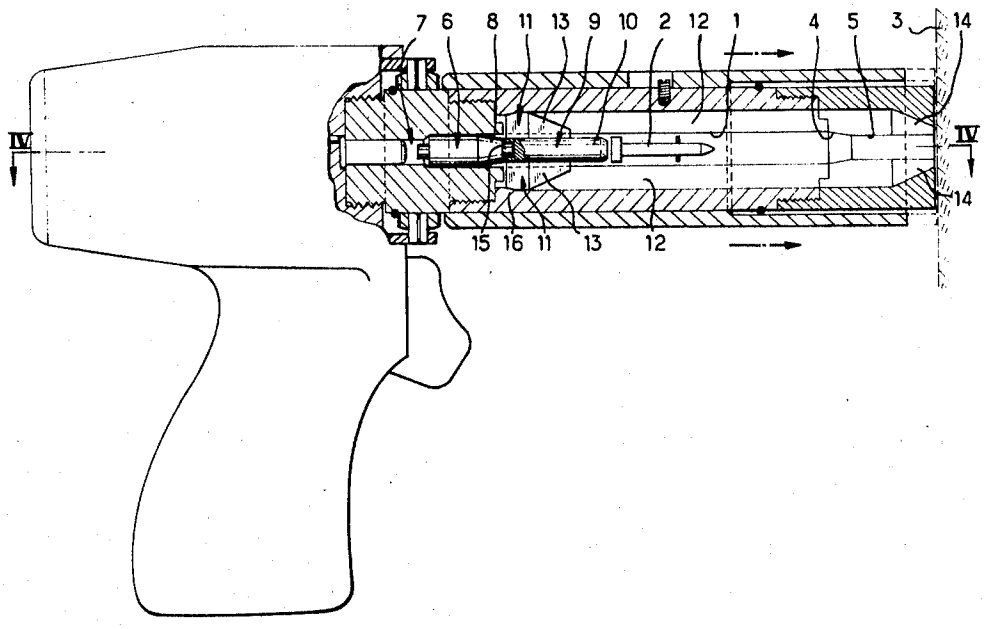
3,199,288	8/1965	Nahas	60/26.1
3,469,504	9/1969	Neighorn	60/26.1
3,292,363	12/1966	Wahl	60/26.1

Primary Examiner—Wendell E. Burns
Attorney—Cushman, Darby & Cushman

[57] **ABSTRACT**

Apparatus of the type in which explosion of a cartridge serves to drive a pin into a hard material is provided with a piston ram for driving the pin. The piston ram is made in at least two distinct parts, and each of the ram parts is provided with a stop surface which engages a corresponding stop surface of the apparatus so as to ensure successive stopping of the distinct parts of the piston ram upon firing of the apparatus.

19 Claims, 28 Drawing Figures



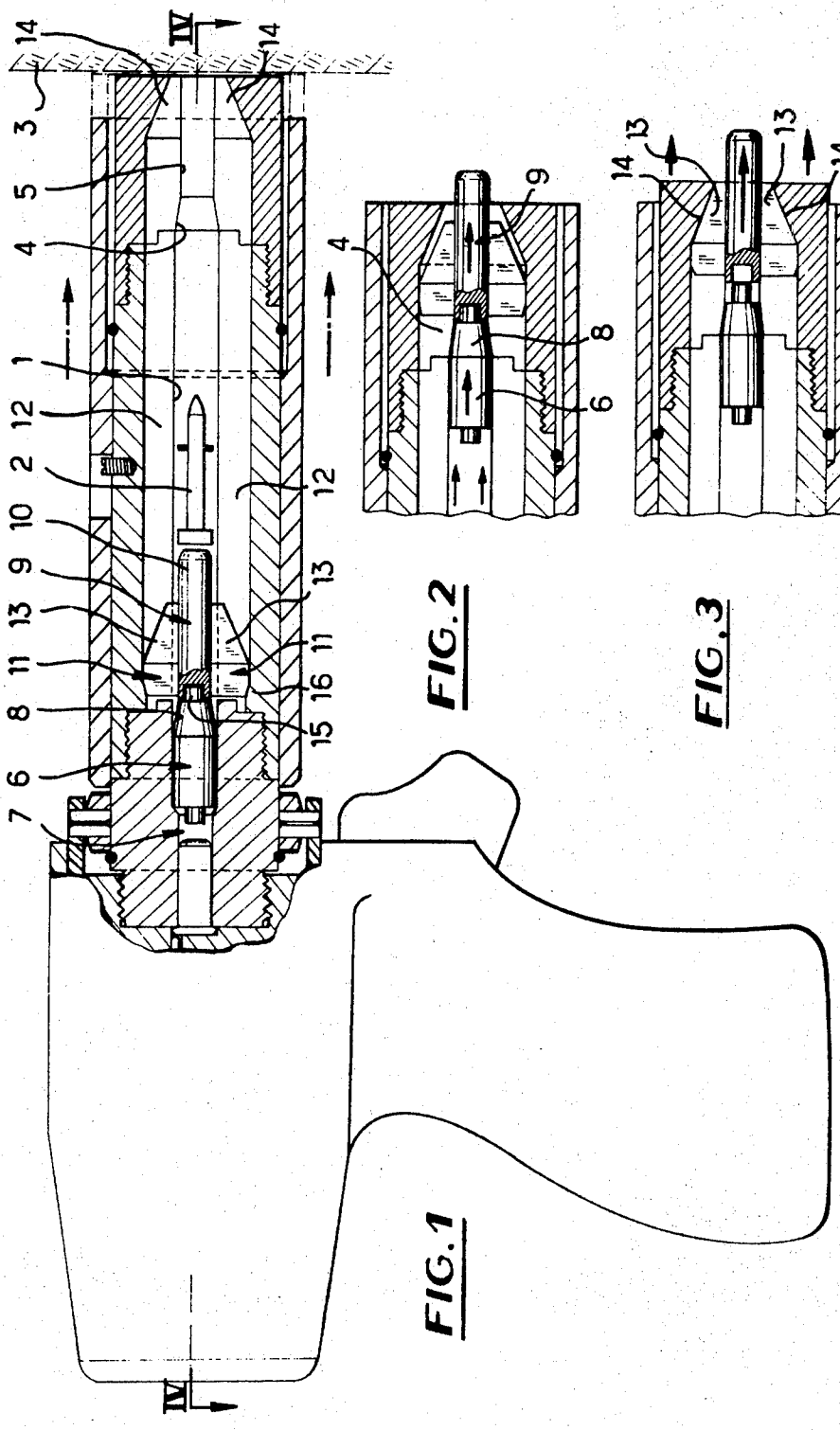


FIG. 1

FIG. 2

FIG. 3

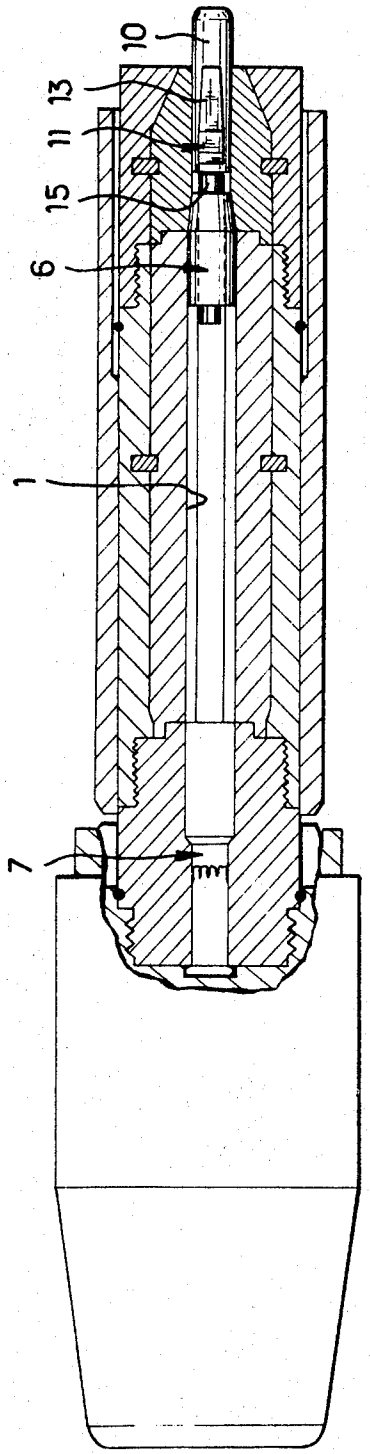
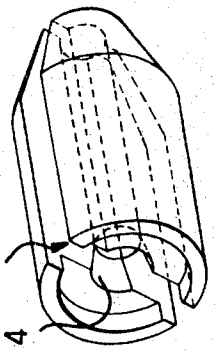


FIG. 4



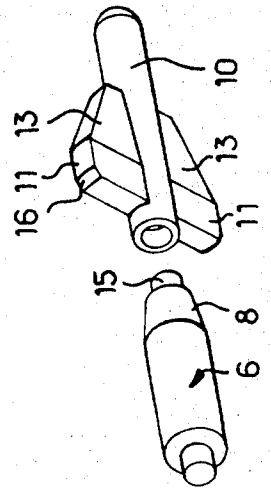


FIG. 5

FIG. 6

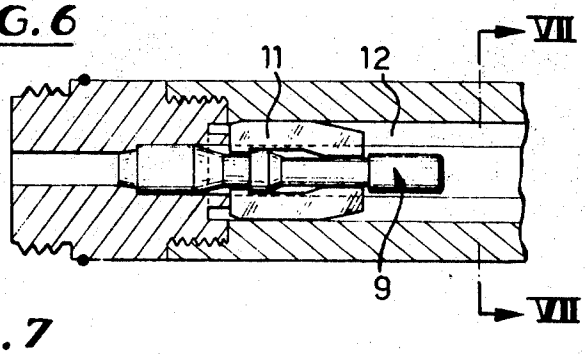


FIG. 7

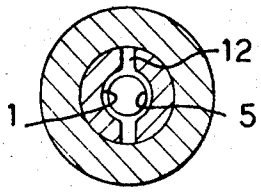


FIG. 8

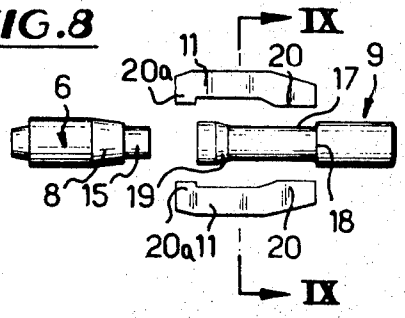


FIG. 9

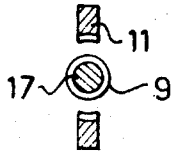


FIG. 10

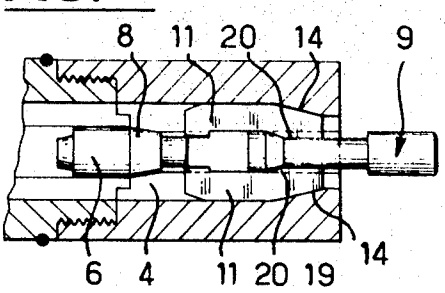


FIG. 11

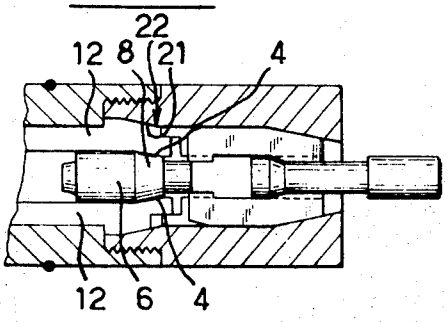


FIG. 12

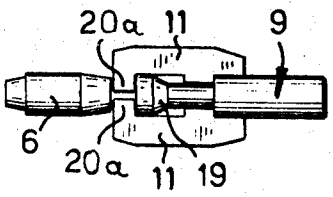


FIG. 13

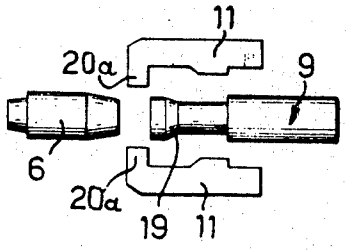


FIG. 14

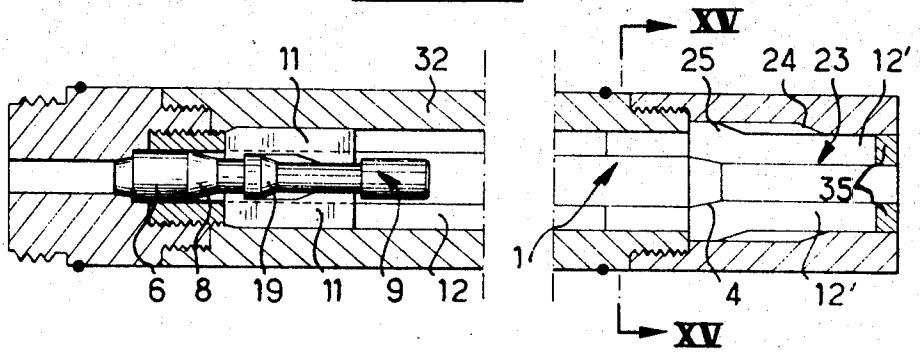


FIG. 15

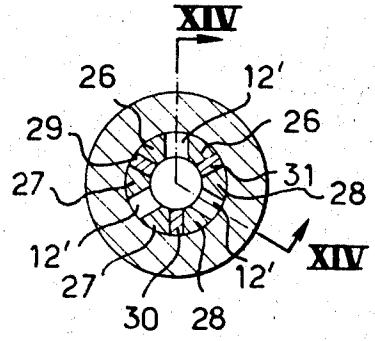


FIG. 16

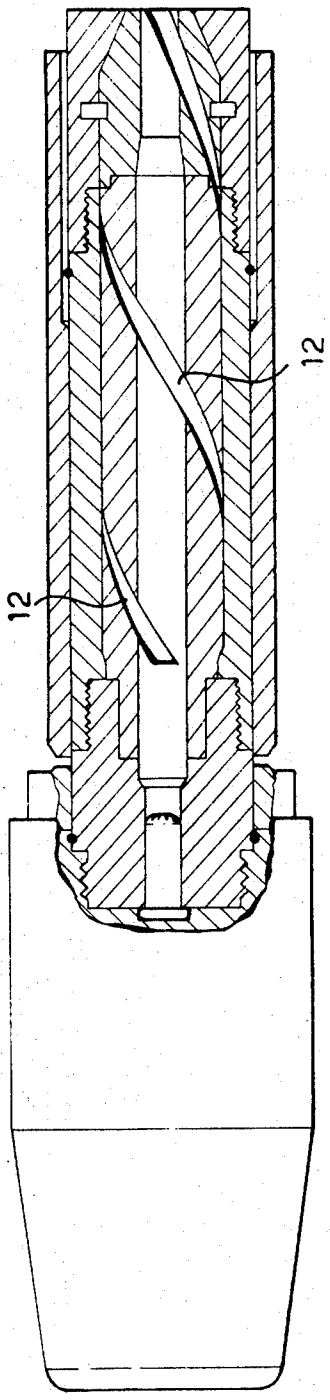
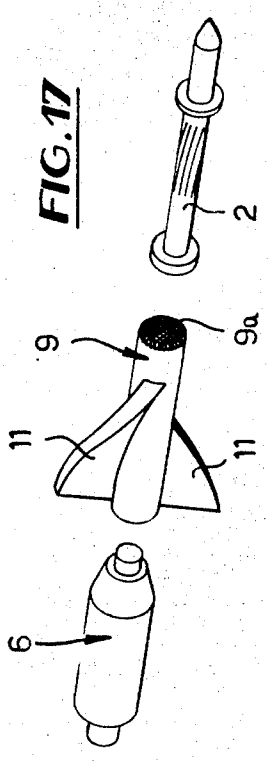


FIG. 17



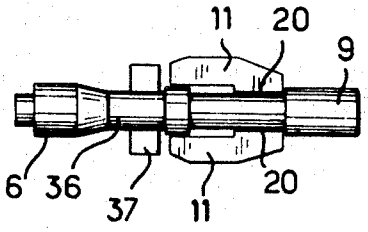
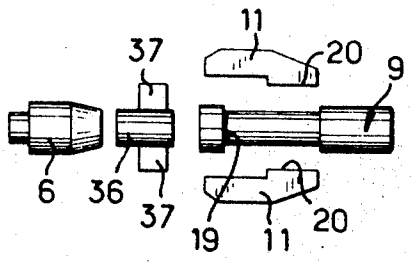


FIG. 18

FIG. 19



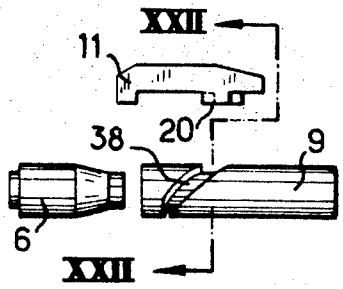


FIG. 20

FIG. 21

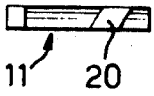


FIG. 22

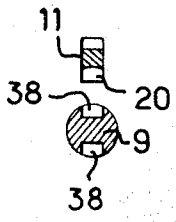


Fig: 23

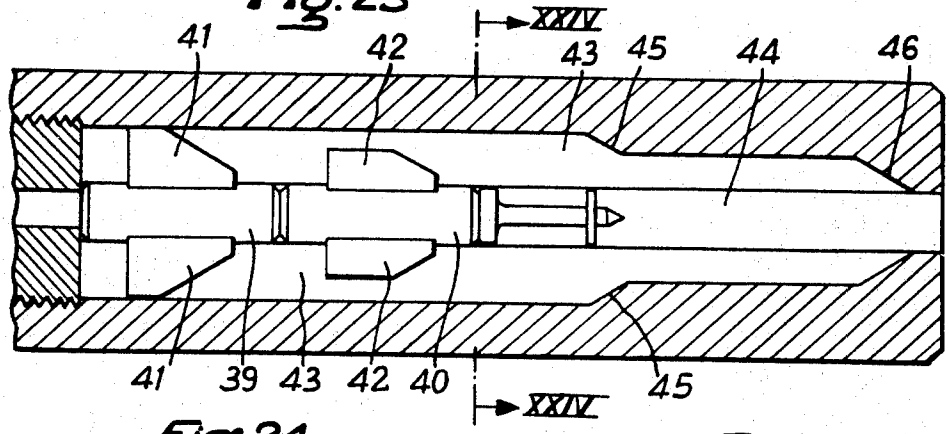


Fig: 24

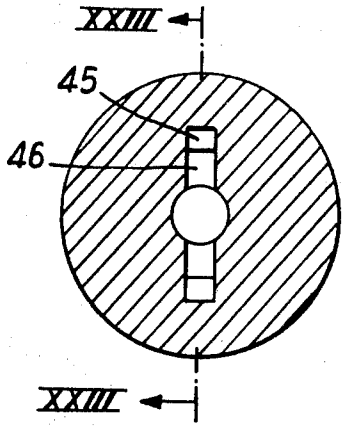


Fig: 26

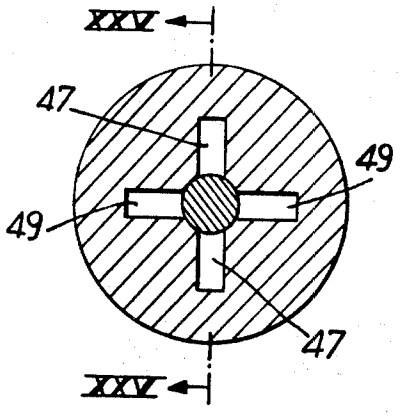
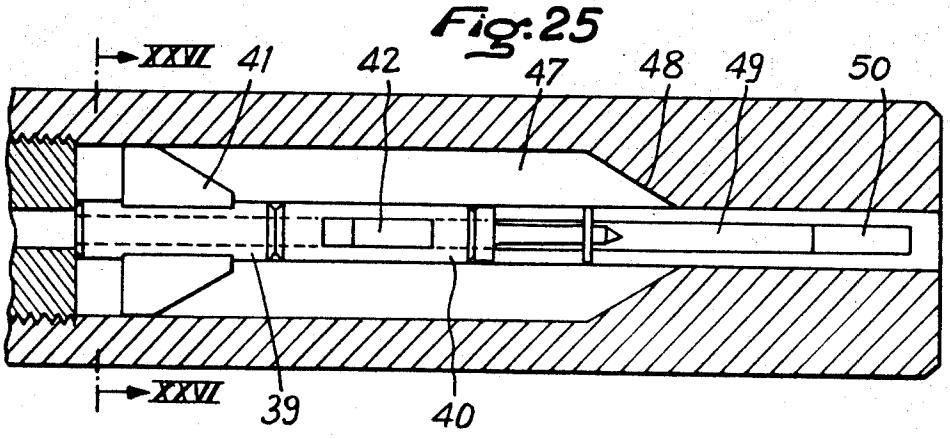


Fig: 25



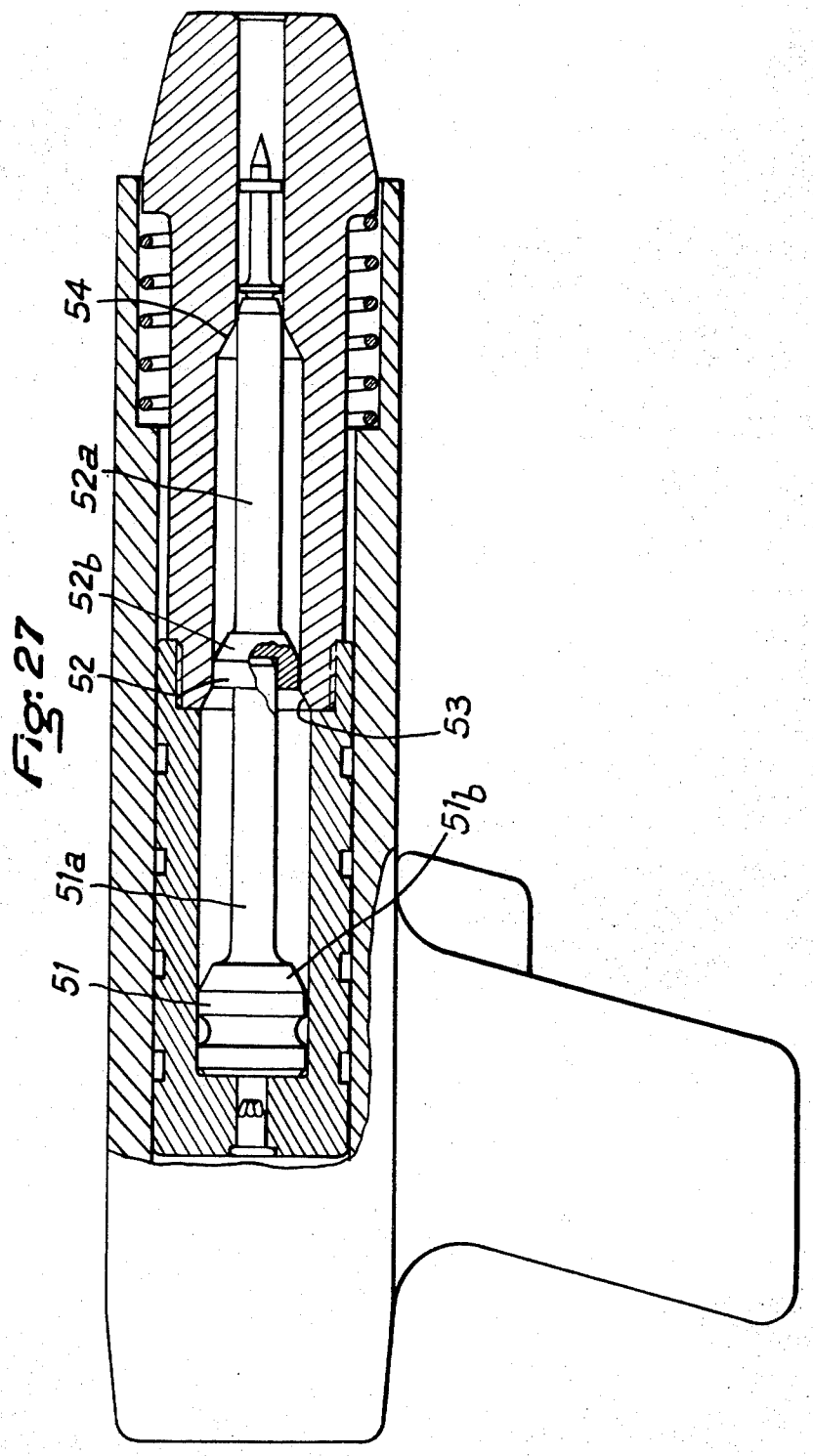


Fig. 27

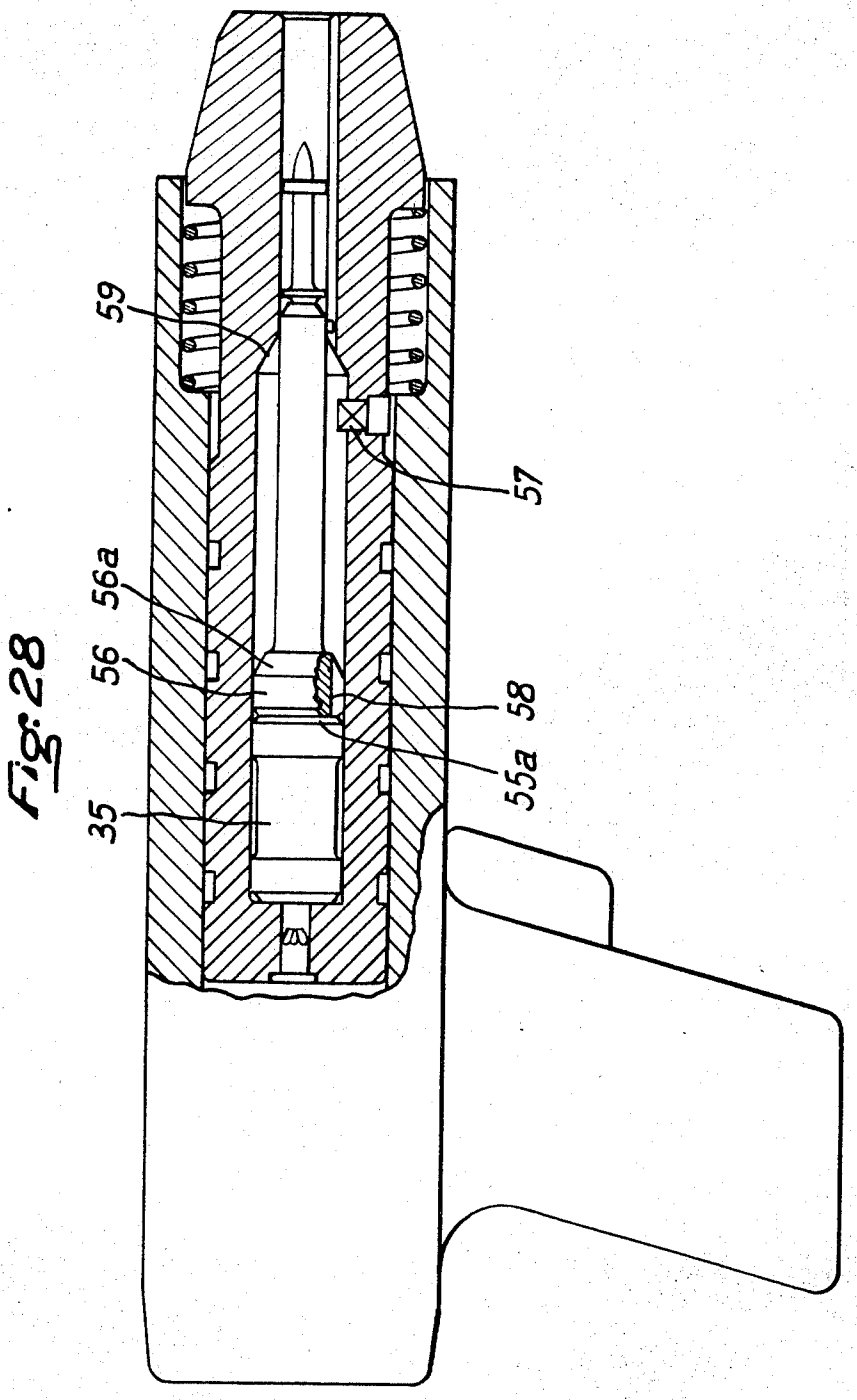


Fig. 28

CARTRIDGE ACTUATED TWO PART RAM

The present invention relates to a fixing apparatus for joining, said invention constituting an improvement.

Fixing apparatus for joining are already known, called "piston ram" or "hammer" apparatus, in which gases deriving from the explosion of a cartridge drive a pin or similar element into a hard material, bearing on an intermediate piece that constitutes the "piston ram" or "hammer".

The present invention relates to a fixation apparatus of this type, more especially to an apparatus for fixation in which a piston ram is used that slides within the apparatus, in the same hollow as the pin or nail that is driven in by the apparatus, the piston ram being stopped at the end of its stroke by a slight shoulder across which it cannot pass, but across which the pin or mail is able to pass.

Such apparatus for fixation, of known type, allow production of piston rams that are of relatively small bulk, which allows an increase of the speed of propulsion of the pin while retaining the advantages of so-called piston ram apparatus.

The present invention relates to an apparatus of this latter type in which the piston ram is designed so as to promote its halt at the end of the stroke in case of abnormal firing. Moreover, in facilitating the halt, the invention allows reduction of the shock of the piston ram against the stop device against which it must abut at the end of the stroke. Wear is thus reduced, both for the piston ram and for the guide element of the apparatus.

The present invention relates to a new product of manufacture that comprises a cartridge driven piston ram type of apparatus for fixation, in which the piston ram moves inside the orifice of the guide element in which the pin that is to be driven in likewise moves, the said apparatus being characterized in that the piston ram is made in at least two discrete parts, each part having a stop surface intended to abut against a corresponding stop surface of the apparatus, at least one of the said stop surfaces of the apparatus being integral with the guide element of the apparatus, the said corresponding stop surfaces of the apparatus ensuring the successive halting of the different discrete parts of the piston ram.

In a first embodiment of the invention, the various corresponding stop surfaces of the apparatus are all integral with the guide element of the apparatus, each cooperating with one of the stop surfaces of the piston ram. In this embodiment, the apparatus being assumed to be in its initial firing position, the distance between the stop surface of the rear part of the piston ram that is nearest the firing chamber (seen in the direction of driving in) and the corresponding stop surface of the guide element is less than the distance between the stop surface of the following part of the piston ram and the corresponding stop surface for this second part of the guide element. When the piston ram presents more than two parts, this distance increases still more for each part as the distance from the first part that is most deeply seated in the guide element increases.

On the other hand, in the other embodiments of the invention, the corresponding stop surfaces may be provided on parts of the piston ram themselves. Thus for example in the case of a piston ram in two successive parts, a single stop surface integral with the guide element can be provided, said surface cooperating with a complementary stop surface presented by the part of the piston ram that is most deeply lodged in the guide element, said part of the piston ram presenting a second stop surface against which a corresponding stop surface of the second part of the piston ram abuts. In this way, in case of abnormal firing, the first part of the piston ram (the most deeply lodged) abuts first against the stop surface that is integral with the guide element, and then the second part moves with reference to the first part until it is stopped by the second stop surface of the first part.

In an especially advantageous embodiment of the invention, the apparatus is characterized in that the piston ram is in at least two distinct parts that are stopped independently of each other at the end of the stroke, at least part of the piston ram being integral with radial fins that slide in corresponding recesses in the guide element, the part comprising the said fins being stopped at the end of its stroke by the fact that the said fins abut against the end of the recesses of the guide element that contain them.

In such a form of embodiment of the invention, the piston ram is constituted by a first rear part whose diameter corresponds to the diameter of the hollow of the guide element, said part comprising on the side opposed to the explosion chamber a conical surface that is stopped by a shoulder of the same form at the front of the guide element. This first part cooperates with a second forward part of the piston ram that is furnished with at least two radial fins that slide in recesses of corresponding form in the guide element, the body of the said part of the piston ram that is supplied with fins having a diameter that is sufficiently small to pass across the shoulder at the end of the guide element, whereas the fins are applied to the end of the recesses in which they slide.

In a preferred embodiment, the ends of the said recesses, as well as the corresponding surfaces of the fins, present sloping surfaces to cause the stopping of the forward part of the piston ram on an inclined shoulder.

In another modification of this first form of embodiment, the recesses in which the fins move present a decreasing width at their ends, so as to wedge the fins, which are similarly thinned at their forward ends.

In a modification, the fins, instead of being made along the radial planes of the piston ram, may be arranged helicoidally about the axis of the piston ram and move in grooves that are also helicoidal, on the guide element.

In this way a movement of rotation can be imparted to the piston ram, which in turn can be communicated to the nail or other element that is driven in by the apparatus.

According to a second form of embodiment of the invention, the part of the piston ram that is stopped by the fins can slide axially with reference to the fins, so that there is first attained a stopping of the fins and then a stopping of the part of the piston ram that is integral with the fins.

In this form of embodiment, the fins may advantageously be constituted severally by an independant piece that slides in its groove, the part of the piston ram that is integral with the fins being held on

the fins by the fact that the inner edges thereof engage in recesses in the body of the said forward part of the piston ram.

In another embodiment, the piston ram may be constituted by four groups of pieces that are stopped successively at the end of the stroke in the case of abnormal firing.

The said four groups are constituted: by the rear part that ensures the obturation of the combustion chamber, by an intermediate part that is disposed between the rear part and the forward part, the said intermediate part being furnished with fixed fins that slide in recesses of the guide element, by the body of the forward part and by the fins that are axially movable with reference to the said body. The special feature of this form of embodiment is that when the fins of the forward part are stopped on the end of the conical recesses of the guide element, the intermediate part bears via its fins on the movable fins of the forward part and thus causes a wedging on the body of the forward part that is thus braked by friction before it comes into abutment at the end of its stroke.

According to another form of embodiment of the invention, the fins of the forward part may be mounted so as to be able to slide with reference to the forward part not along an axial path as in the embodiment described above, but on a helicoidal path. As a result, since the fins are immobilized in rotation by the recesses of the guide element, the body of the forward part is carried by inertia in a helicoidal movement when the fins are halted by their stops. This helicoidal movement of the body of the forward part is favorable to the braking action that is effected thus on a longer path, and with the help of the friction of the fins on their helicoidal ramps of the body of the forward part.

The number of fins is not a characteristic of the invention. However, it is preferably to use two or three fins to ensure guidance and satisfactory halting of the forward part of the piston ram.

Other features and characteristics of the invention will become evident in the course of the following description of several embodiments that are shown in the attached drawing, in which:

FIG. 1 is a schematic view in partial section of an apparatus of fixation according to the invention,

FIGS. 2 and 3 are views in partial section of the forward part, showing two phases of the stopping of the piston ram,

FIG. 4 is a schematic view in section along IV–IV of FIG. 1,

FIG. 5 is a view in perspective of the piston ram and of the stop sleeve of FIGS. 1 to 4,

FIG. 6 is a view in axial section at the moment of firing of the part that comprises the piston ram of an apparatus according to a second embodiment of the invention,

FIG. 7 is a section along VII—VII of FIG. 6,

FIG. 8 is an exploded view of the different pieces that constitute the piston ram of FIG. 6,

FIG. 9 is a view in section along IX—IX of FIG. 8,

FIG. 10 is a view in section of the forward end of the apparatus of FIG. 6 after firing,

FIG. 11 is a modification of FIG. 10,

FIGS. 12 and 13 are assembled and separate views of the pieces that constitute a piston ram according to a modification of FIG. 8,

FIG. 14 is a view in broken section of an apparatus in which the piston ram is stopped by a movable sleeve disposed at the end of the guide element,

FIG. 15 is a section along XV—XV of FIG. 14,

FIG. 16 is a view in section of a modification of FIG. 1,

FIG. 17 is a view in perspective, exploded, of the piston ram and the pin used with the apparatus of FIG. 16,

FIGS. 18 and 19 are mounted and exploded views of the pieces that constitute another modification of the piston ram of the invention,

FIG. 20 is an exploded partial view of another embodiment of the piston ram.

FIG. 21 is a view from below of a fin of FIG. 20,

FIG. 22 is a view in section along XXII—XXII of FIG. 20,

FIGS. 23 and 24 represent an axial section and a transverse section of an apparatus of the invention in which the piston ram is formed by two parts, each of which has fins,

FIGS. 25 and 26 represent an axial section and a transverse section of an apparatus of the type of FIG. 23, but in which the fins of the two parts are disposed in different planes,

FIGS. 27 and 28 represent, in axial section, two modifications of the apparatus of the invention in which the different parts of the piston ram have no fins.

In FIGS. 1 to 4 there is schematically shown a joining apparatus of the piston ram type in which the piston ram moves in the same hollow 1 of the guide element as pin 2 that is to be driven into material 3. The said hollow 1 of the guide element presents a conical shoulder 4 that opens on an orifice 5 of smaller diameter through which pin 2 is to pass.

In accordance with the invention, this embodiment comprises a piston ram furnished at the rear part 6 whose diameter corresponds to the diameter of hollow 1 of the guide element and that ensures in firing position the obturation of explosion chamber 7. The rear part 6 of the piston ram presents a conical shoulder 8 whose form corresponds to the conical shoulder 4 of the guide element.

The piston ram also presents a forward part 9 constituted by a cylindrical body 10 whose diameter is less than the diameter of part 5 of the guide element and that is provided with two fins 11 that slide in radial grooves 12 of the guide element.

As a result, the forward part 9 of the piston ram can slide inside the guide element, being guided by fins 11 that are applied in the corresponding grooves.

The forward parts of fins 11 present at 13 a height and thickness that decreases, for this reason having a pyramidal form to which the form of ends 14 of recesses 12 of the guide grooves correspond, in which grooves the said fins slide.

It will be understood that in these conditions when the forward part 9 of the piston ram is projected to the front of the guide element, it is held inside it because fins 11 abut against ends 14 of grooves 12.

It is clear that this halt would also be attained either by reduction of the thickness of the forward end of the grooves alone, or by reduction of their height alone, or even by the fact that the fins abut against a radial shoulder that would be disposed at the end of the recesses.

To ensure a better separation of the two parts of the piston ram, part 6 presents a stud 15 that engages in a recess of corresponding form at the back of cylindrical body 10 of forward part 9.

There is also shown in FIG. 1, how a reduction of the height of recesses 12 is effected at 16 to the rear of the guide element so as to wedge the forward part 9 at the moment of firing.

The functioning of the device that has been described is as follows:

At the moment of firing, the pieces are in the position shown in FIG. 1. The gun is applied against the receiver material 3, applying sufficient force as indicated by the arrows to free the bolt device for firing.

The cartridge is then fired, which propels toward the right the assembly comprising parts 6 and 9 of the piston ram and pin 2.

In normal firing conditions, the receiver material 3 offers sufficient resistance to brake and stop the pieces of the piston ram by the action of driving in of pin 2.

FIGS. 2 and 3 show what happens in abnormal firing condition, i.e. when the firing is effected into a material that has not sufficient resistance.

In a first stage shown in FIG. 2 the rear part 6 of the piston ram is stopped because its conical surface 8 is applied against corresponding shoulder 4 of the hollow of the guide element while the forward part 9 continues to move. As shown in FIG. 3, the forward part 9 is then stopped because its fins 13 are applied against the inclined stop 14 of the guide element.

It has thus been possible to effect the stop of the piston ram in two distinct phases, each stop member absorbing the energy of a piece whose mass may be substantially equal to half the total mass of the piston ram.

In FIGS. 6 to 10 a modification of the fixing apparatus of the invention is shown.

In this modification, fins 11 can slide axially with reference to the forward part 9 of the piston ram.

For this, part 9 presents a constriction 17 limited in the forward part by a radial shoulder 18 and at the rear by a conical shoulder 19.

Fins 11 are constituted by flat elements that present at their forward part an elevation 20 whose extremities have a configuration corresponding to shoulders 18 and 19 but that are shorter than constriction 17. Therefore when elevation 20 is engaged in constriction 17 the fins are able to slide axially with reference to part 9.

The fins also have a nose 20*a* that assumes a position behind part 9 and bears on stud 15 of the rear part 6 of the piston ram, which is also furnished with a conical shoulder 8 as in the earlier example.

In FIG. 6 there is shown the position of the different pieces at the moment of firing, fins 11 coming into abutment at the rear end of recesses 12 and part 9 being thrust toward the left with reference to fins 11.

Upon firing in abnormal conditions, the halting of the assembly of pieces constituting the piston ram is effected in three stages, i.e. the forward part 6 is stopped in the first place by conical shoulder 4 of the guide element, then fins 11 are stopped because their end bears on stops 14 at the end of recesses 12 and finally the forward part 9 of the piston ram which moves with reference to fins 11 is stopped by the fact that conical shoulder 19 of the constriction is applied against elevation 20 of the fins.

It is understood that according to this embodiment of the invention it has been possible to distribute into three distinct stops the holding back of the piston ram a the end of the stroke. The energies can thus be distributed over three distinct stops that are thus so much the less stressed.

FIG. 11 shows a modification of the embodiment of FIG. 10. In this modification the part of the guide element that presents recesses 12 is made of two half-shells whose external extremity presents a tapered form 21 that bears on an internal bearing piece of corresponding configuration, namely 22, which is integral with the guide element. The two half shells may also undergo slight axial displacement with reference to the guide element.

It is understood that upon the stopping of the rear part 6 of the piston ram the two half shells which have a tendency to be carried toward the right bear on stop 22 with their conical surface 21 bis, which has the effect of tending to tighten their end toward the axis, reinforcing the conical shoulder 4 on which the conical surface 8 of rear part 6 is applied.

Thus a flattening of the conical stop 4 of the guide element through repeated abnormal firing is avoided.

FIGS. 12 and 13 show a modification of the piston ram of FIG. 8.

According to this modification, noses 20a extend until they are almost in mutual contact, as illustrated in FIG. 12, rear part 6 of the piston ram then bearing in the course of firing on the rear end of fins 11, which in turn communicate to forward part 9 the force that is necessary for the driving in of the pin.

In FIGS. 14 and 15 another form of embodiment is shown in which the stopping of the different pieces constituting the piston ram is effected by a movable tip that can move axially with reference to the guide element. In FIG. 14 this movable tip 23 is shown in the course forward, limited by stop 24 which prevents the passage of shoulder 25 that is an integral part of tip 23.

The said tip is connected to the guide element by a clutch device, the teeth of the tip engaging between corresponding teeth that are at the end of the guide element.

FIG. 15 shows how the three teeth 26, 27 and 28 of tip 23 engage between teeth 29, 30 and 31 that are integral with the half shells screwed at 33 into the cartridge holder 34 joined to guide element 32.

The recesses 12 of the guide element extend at 12', passing through the middle of the clutch teeth of the tip. There are three here for the passage of a piston ram with three fins.

It is to be seen then that tip 23 can slide with reference to the guide element while ensuring the continuity of hollow 1 inside which the piston ram and the pin that is to be driven in move.

In the lefthand part of FIG. 14 there is an embodiment of the piston ram that is similar to the embodiment of FIG. 8, the only difference being that fins 11 have a radial front part.

According to this embodiment, the stopping of the piston ram is effected according to the following stages:

Shoulder 8 of the forward part 6 of the piston ram abuts against corresponding shoulder 4 of the movable tip 23 which begins to move toward the right, immobilizing part 6 with reference to itself whereas the fins 11 and forward part 9 continue to move with reference

to the tip until fins 11 bear on shoulder 35 which is disposed at the end of the tip since part 9 is then stopped because its shoulder 19 is applied to the fins as explained before.

Thus in this embodiment there is the advantage resulting from the fact that the moving pieces constituting the piston ram are stopped in three stages, and that this stopping is effected on a piece that is itself mobile.

In FIG. 16 there is a modification of FIG. 1 according to which recesses 12 in the guide element of the apparatus to allow sliding and to ensure the guiding of fins 11 of the forward part 9 of the piston ram are made in helicoidal form, fins 11 themselves having a corresponding helicoidal configuration.

The forward part 6 of the piston ram presents characteristics that are similar to those of the apparatus shown in FIG. 1.

It will be understood that in this embodiment of the invention the forward part 9 of the piston ram is carried in a helicoidal movement because of the special form of fins 11 and recesses 12.

This helicoidal movement has the effect of imparting a movement of rotation to pin 2 that is propelled.

To promote the driving in rotation of the pin by the forward part 9 of the piston ram, the forward end of the latter element is provided with a milling or guilloche pattern 9a that allows the driving of pin 2 in rotation by virtue of the friction that results.

FIGS. 18 and 19 show another embodiment of the piston ram of the invention, made in four groups of pieces. These groups are, as in the earlier embodiments, the rear part 6 that obturates the combustion chamber, the forward part 9 that is itself constituted by a central body and by fins 11 which are movable with reference to the said central body, and in addition in the present case, an intermediate part 36 that also has fins 37 that are slidable in recesses 12 of the guide element in which fins 11 move.

FIG. 18 shows the different pieces at the moment of firing.

As in the embodiments previously described, upon firing, the assembly of the pieces is driven toward the right propelling the pin, the rear part 6 bearing on intermediate part 36 which in turn bears on forward part 9 which propels the pin.

In case of firing in abnormal conditions, it is the rear part 6 that is stopped first by bearing on conical stop 4 in the orifice of the guide element.

Intermediate piece 36 as well as forward piece 9 continue to move toward the mouth.

Next it is fins 11 that are stopped because their sloped end bears on the sloped end of recesses 12, the inclined end being of corresponding configuration.

As soon as fins 11 are immobilized, the assembly comprising the body of the forward part 9 and intermediate part 36 continues to move toward the right.

Very rapidly, fins 37 of central part 36 bear against the rear ends of fins 11, exerted on them an axial force that the action of the inclined stops at the end of grooves 12 causes a tightening of elevations 20 of fins 11 against the central part of body 9, which contributes to the stopping of the forward part 9 by the effect of friction.

It is understood therefore that according to the embodiment of the piston ram just described, the halting of the assembly of pieces constituting the said piston ram is effected in four stages, i.e.: the stopping of the rear part, the stopping of fins 11 on the end of recesses 12 of the guide element in which they slide, the stopping of the intermediate part 36 that is applied to fins 11, and finally the stopping of the central body of forward part 9 which, before its application to the fins, is braked by friction caused by elevations 20 of the fins that are in turn pushed forward by intermediate part 36.

This embodiment has been described with two fins 11 but it is evident that it may also be made with a different number of fins, e.g., three fins.

In FIGS. 20 to 22 another embodiment of the piston ram of the invention is shown.

According to this embodiment, fins 11 are slidable along a helicoidal path with reference to the central body of forward part 9 of the piston ram.

This helicoidal path is imposed on the relative displacement of the fins with reference to the body of the forward part by helicoidal grooves that are hollowed in the central part and in which elevations of corresponding configuration on the fins engage.

To simplify the drawing, FIG. 1 shows a single fin 11 and a single helicoidal groove 38. It is obvious, however, that the piston ram of the invention has at least two diametrically opposed fins 11 and that consequently there are two grooves 38 only one of which is illustrated in the present case.

FIG. 21 is a view from below of fin 11, on which there is clearly seen the form of elevation 20 that is substantially that of a parallelogram, to be able to engage in helicoidal groove 38.

FIG. 22 shows a view along XXII—XXII of FIG. 20, on which there is seen the body of forward part 9 provided with two helicoidal grooves 38 (of which only one was shown in FIG. 20). A fin 11 is also to be seen, in end view, with its elevation 20.

In this connection it is to be noted that the part of fin 11 that is applied to central body 9 has a cylindrical periphery of the same diameter, to facilitate helicoidal movement of part 9 with reference to fin 11.

The operation of the device just described is substantially the same as that of the device shown in FIGS. 6 to 10 described previously. The essential difference in the functioning of this embodiment resides in the fact that as soon as fins 11 are immobilized after coming into contact with the end of recesses 12 in which they slide, the body of forward part 9 of the piston ram continues its forward movement being subject to a helicoidal movement, i.e., undergoing a movement of rotation with reference to the fins and also with reference to the apparatus.

This movement of rotation offers the advantage of braking the body of part 9 of the piston ram still more, particularly through friction that develops in the course of this movement.

We refer now to FIGS. 23 and 24.

In this embodiment, the piston ram is in two parts 39, 40, each furnished with two opposed radial fins, 41, 42, said fins sliding respectively in two longitudinal radial recesses 43 on opposite sides of the core of guide element 44. Recesses 43 present a first corresponding stop surface 45 obtained by a reduction of the height of the said recesses. Thus, upon firing, fins 41 of the rear part

39 of the piston ram first bear against surfaces 45 while part 40 of the piston ram, by virtue of its smaller fins 42, continues its course whereas part 39 is blocked. The course of part 40 continues until fins 42 in turn bear against surfaces 46 which close off recesses 45. Of course, when the apparatus is in its initial position before firing, as shown in FIG. 23, the distance between a fin 41 and the corresponding surface 45 is less than the distance between a fin 42 and its corresponding stop surface 46. This embodiment makes it possible, as shown, to use parts 39 and 40 of the piston ram with the same diameter, there being no narrowing of guide element 44 itself.

Referring to FIGS. 25 and 26, we see an apparatus with a two-part piston ram 39, 40 which parts are identical to the same parts of FIG. 23, with the difference that fins 41 are disposed in a plane perpendicular to that of fins 142. In these conditions, fins 41 move in radial recesses 47 that end in abutting surfaces 48 whereas fins 42 move in recesses 49 that are perpendicular to recesses 47, said recesses 49 ending in surfaces 50. Of course, recesses 49 in which fins 42 move are extended toward the right beyond the stop surfaces 48 that terminate recesses 47.

We refer to FIG. 27.

In this form of embodiment of the invention, the piston ram is made in two parts 51, 52, the diameter of part 51 being greater than that of part 52. Part 51 has a stem 51*a* that, in the starting position, penetrates into an orifice of the front surface of part 52, which in turn presents an extension 52*a* whose front end thrusts the pin. Part 51 of the piston ram has moreover a stop surface 51*b* which is of truncated configuration and that, upon firing, is applied against a truncated stop surface 53 of the guide element. Similarly part 52 has a truncated stop surface 52*b* that can be applied against a truncated surface 54 of the guide element. The distance that separates surface 51*b* from the surface of stop 53 is less than the distance that separates surface 52*b* and surface 54.

Referring to FIG. 28, we see that the piston ram is made in two parts 55 and 56 which this time have the same diameter. In its course, the forward part 55 is applied against a spur 57 that projects into the guide element of the apparatus. In order not to be blocked by said spur 57, the front part 56 of the piston ram has a flattened surface 58 that allows it to pass over spur 57 finally to be applied by its surface 56*a* against the truncated stop surface 59 of the guide element. Any means, not represented, prevent part 56 of the piston ram from pivoting about its longitudinal axis, so that its flattened surface 58 is always opposite the stop constituted by spur 57. There again, the distance separating front surface 55*a* of part 55 from spur 57 is less than the distance that separates the truncated surface 56*a* from the corresponding truncated stop surface 59.

I claim:

1. Apparatus for the fixation of pins or similar elements functioning with a cartridge, of the type comprising a piston ram that moves inside the guide element in the same hollow thereof in which the pin moves, characterized in that the piston ram is made in at least two distinct parts, each part being provided with a stop surface intended to be applied against a corresponding stop surface of the apparatus, at least one of the said corresponding stop surfaces of the apparatus being integral with the guide element of the apparatus, the said corresponding stop surfaces of the apparatus ensuring the successive halting of the different discrete parts of the piston ram.

2. Apparatus as in claim 1, characterized in that it comprises at least two successive stop surfaces that are integral with the guide element of the apparatus, the distance that in the initial firing position separates the stop surface of the part of the piston ram that is nearest to the firing chamber from the corresponding stop surface that is integral with the guide element being less than the distance that separates the stop surface of a part of the piston ram that is more distant from the firing chamber from the corresponding stop surface that is integral with the guide element.

3. Apparatus as in claim 1, characterized in that the piston ram is made in at least two distinct parts that are stopped independently of each other at the end of the stroke, at least one of the parts of the piston ram being integral with radial fins that slide in corresponding recesses in the guide element, the part presenting the said fins being stopped at the end of its stroke by the fact that the said fins are applied to the end of the recesses that enclose them.

4. Apparatus as in claim 3, characterized in that the piston ram is constituted by a first forward part whose diameter corresponds to that of the hollow of the guide element, said forward part being furnished with a conical surface on the side of the mouth of the guide element, the said conical surface being applied at the end of the stroke to a shoulder disposed at the mouth of the guide element, and by a forward part that is integral with radial fins that slide in recesses in the guide element, the body of said forward part of the piston ram having a diameter sufficiently small to pass across the shoulder that serves as a stop for the rear part of the piston ram.

5. Apparatus as in claim 3, characterized in that the part of the piston ram that comprises the fins in constituted by a central cylindrical body whose diameter is less than that of the shoulder of the guide element and that has a circular constriction, the fins being constituted by flat elements that present an elevation that engages in the said constriction, and a nose that engages on the rear part of the said body, so as to allow an axial sliding of the body of the forward part with reference to the fins, whereas on firing the propulsion of the pin is ensured while the body of the forward part is shifted backward with reference to the fins.

6. Apparatus as in claim 3, characterized in that the rear part of the piston ram acts directly on the body of the forward part.

7. Apparatus as in claim 3, characterized in that the rear part of the piston ram acts on the body of the forward part by means of the fins.

8. Apparatus as in claim 3, characterized in that the fins gradually diminish in height toward their front ends and that the end of the recesses that enclose the fins have a corresponding configuration.

9. Apparatus as in claim 3, characterized in that the fins have a thickness that decreases toward the front and that the ends of the grooves in which they slide have a corresponding configuration.

10. Apparatus as in claim 4, characterized in that the shoulder of the guide element that serves to stop the forward part of the piston ram is supported by a piece capable of sliding axially, being held substantially at the level of the conical shoulder by a conical piece so as to tend to close up the shoulder of the guide element that stops the rear part of the piston ram.

11. Apparatus as in claim 5, characterized in that the piston ram comprises an intermediate part furnished with fins that slide in the same recesses as the fins of the forward part, the said fins of the intermediate part being applied against the fins of the forward part to cause a gripping of the body of the forward part between the elevations of its fins when the latter elements are applied against the sloped ends of the recesses in which they slide.

12. Apparatus as in claim 3, characterized in that the fins are fixed on the body of the forward part of the piston ram by means of helicoidal ramps that impose on the body of the forward part of the piston ram a helicoidal movement when the fins are stopped by application against the ends of the recesses of the guide element in which they slide.

13. Apparatus as in claim 3, characterized in that the piston ram presents two or three fins.

14. Apparatus as in claim 3, characterized in that the forward end of the guide element that presents stops for the different pieces of the piston ram is a movable sleeve that slides axially, joined by a clutch device to the rear part.

15. Apparatus as in claim 3, characterized in that the radial fins have a helicoidal configuration, as well as the recesses by which they slide along the guide element, so as to communicate a rotation to the pin as it is driven in.

16. Apparatus as in claim 3, characterized in that at least two parts of the piston ram, of which the first is nearest the explosion chamber, are provided with fins that move in corresponding recesses in the guide element.

17. Apparatus as in claim 16, characterized in that the recesses of the fins of the part nearest the explosion chamber extend the recesses of the fins of the second part.

18. Apparatus as in claim 2, characterized in that the piston ram is made in at least two parts, the part nearest the explosion chamber having the greater diameter, and the diameters of the other parts diminish in succession, the diameter of the guide element correspondingly presenting successive portions with decreasing diameters that are joined to each other by shoulders that serve as stop surfaces.

19. Apparatus as in claim 2, characterized in that the piston ram is made in at least two parts, the part nearest the explosion chamber being applied against a spur that projects into the guide element, the following part presenting a form that allows it to avoid the said spur as it passes.

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