

United States Patent

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 [33] **Italy**
 [31] **17594A/69**

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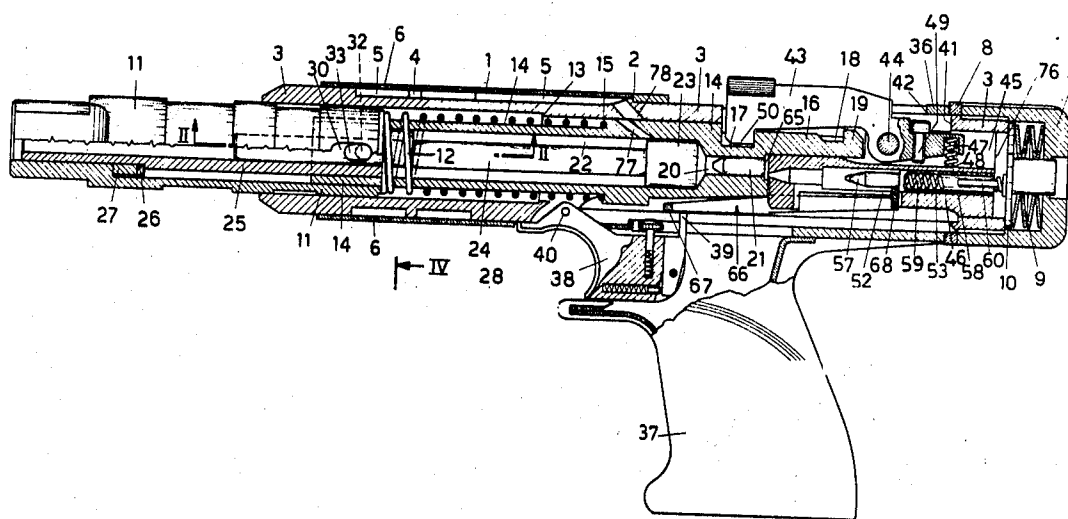
[54] **NAIL-DRIVING GUN**
7 Claims, 14 Drawing Figs.

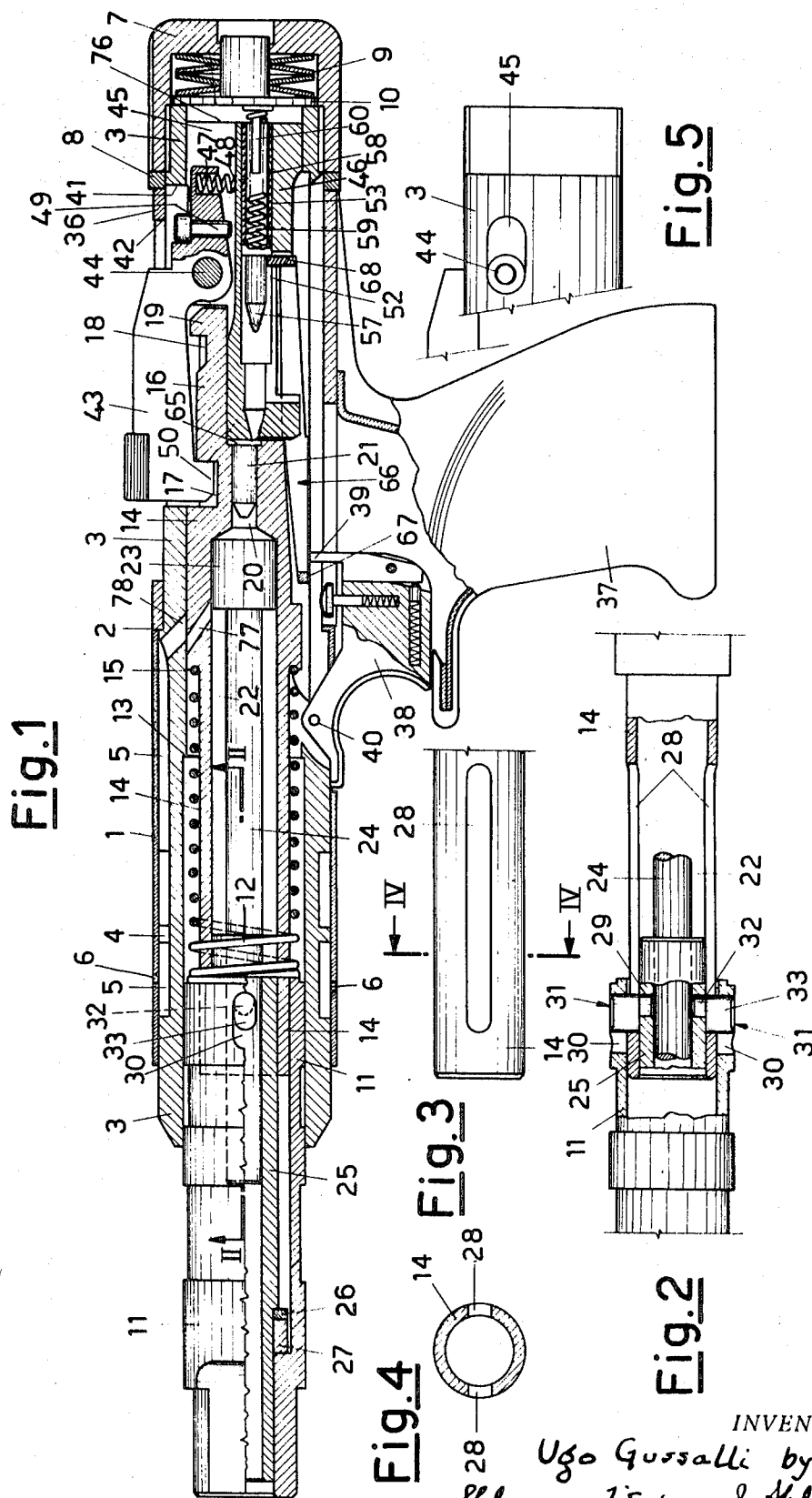
[52] U.S. Cl. **227/8,**
227/10
 [51] Int. Cl. **B25c 1/14**
 [50] Field of Search **227/8, 10,**
11

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ABSTRACT: A nail-driving gun is disclosed of the kind in which the propulsive force of a powder cartridge is used to drive a nail or the like into a solid body through the intermediary of a ram actuated by the explosion gases generated by the cartridge. The shortcoming has been experienced in conventional guns of this kind that no adjustability of the mechanisms is provided as a function of the nail length, or of the length through which one desires that the nail can penetrate. A telescopable adjustment member is provided by the invention; and recoil spring and detent and tripping mechanisms are also provided. Shock absorber and momentum-dissipating members are also provided at appropriate places in the gun.





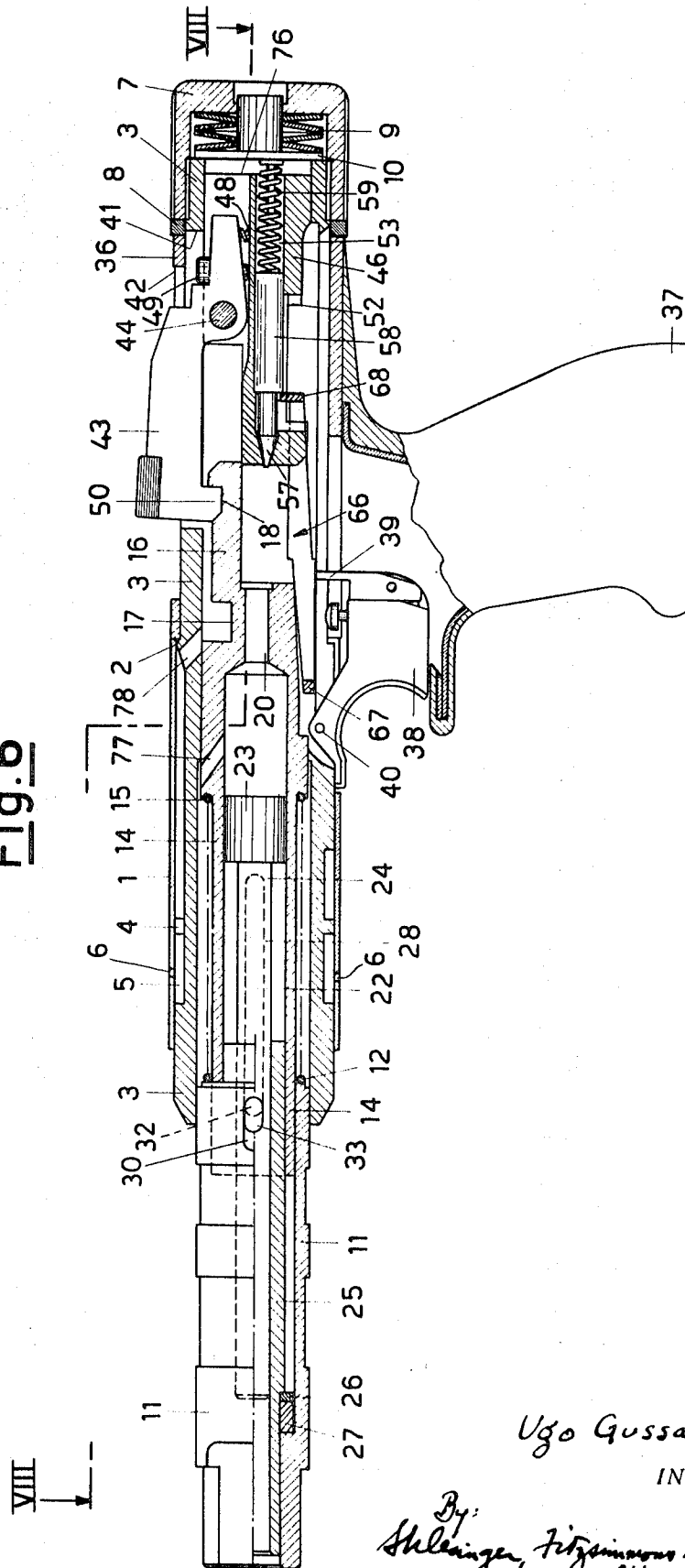
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Fig. 6

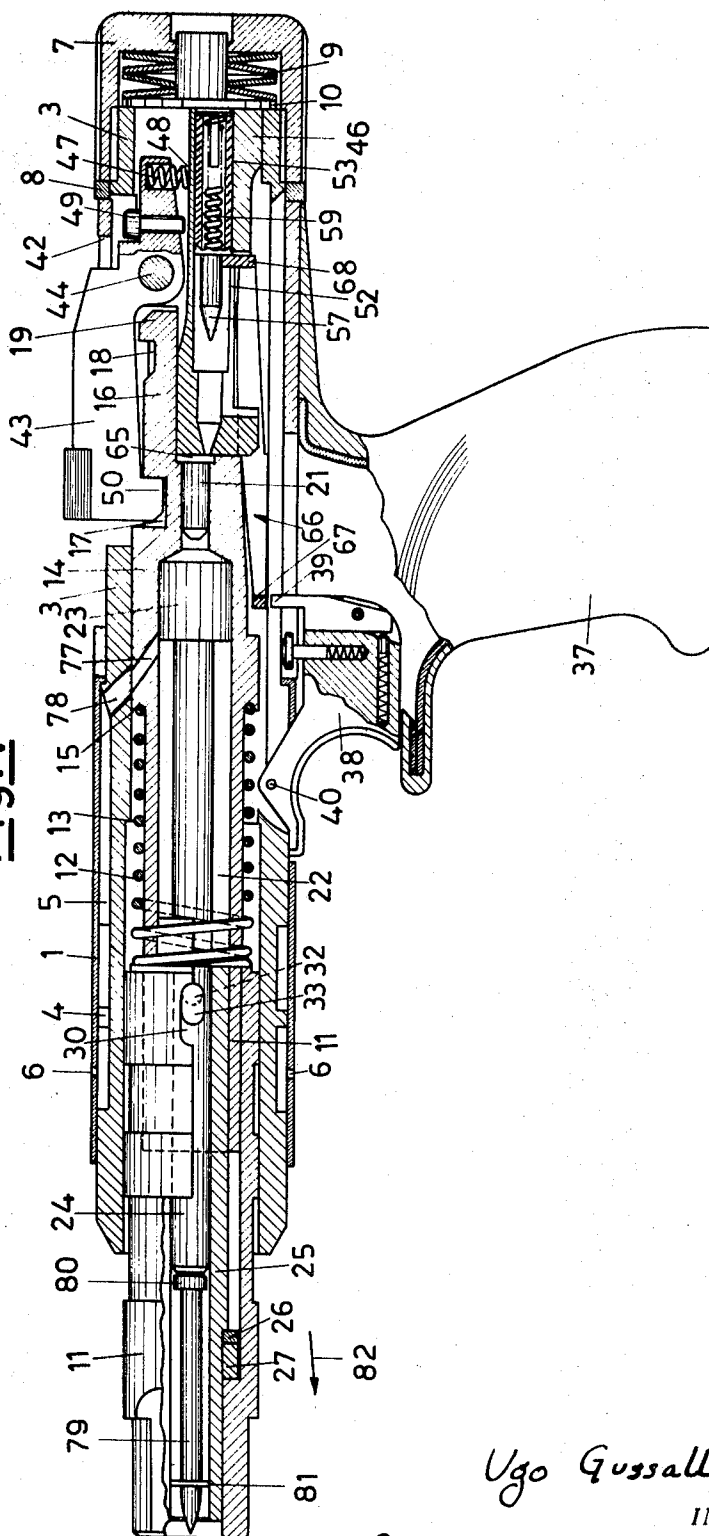


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Fig. 7

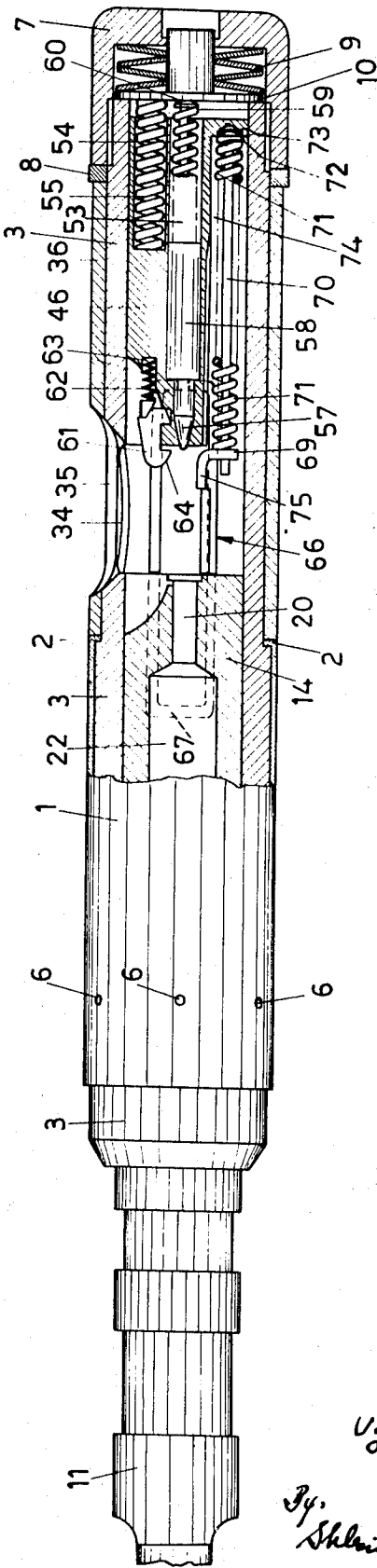


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Fig. 8



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Fig.9

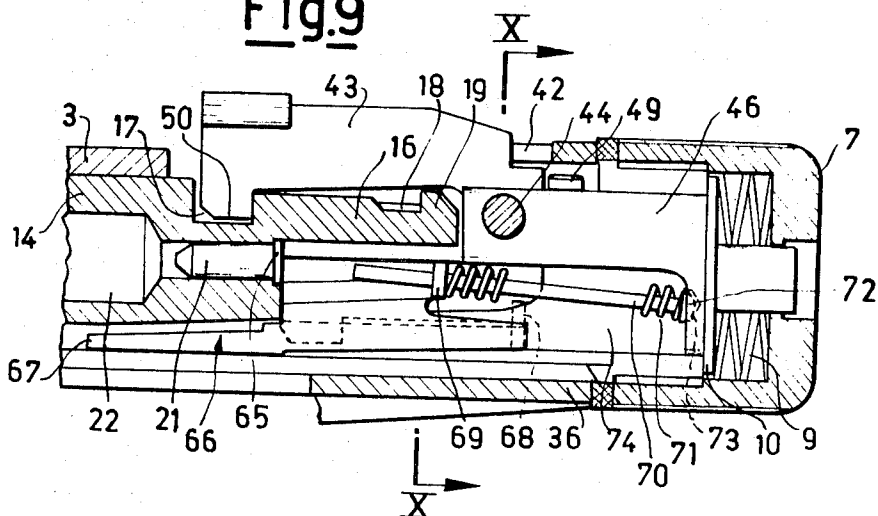
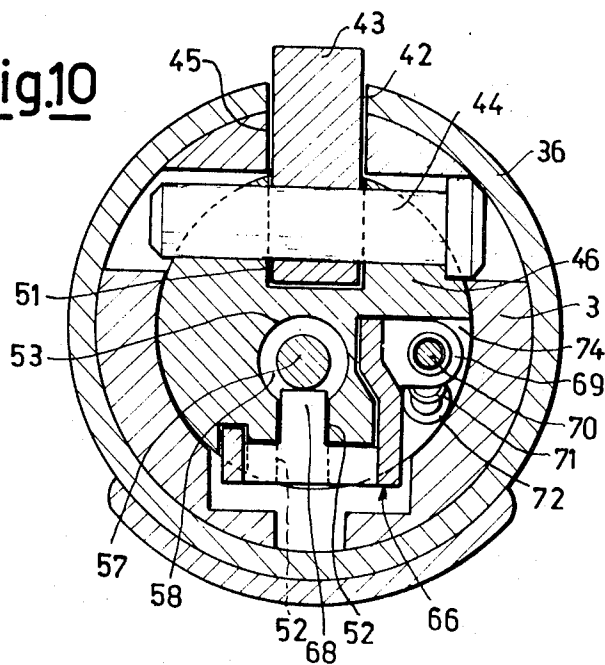


Fig.10



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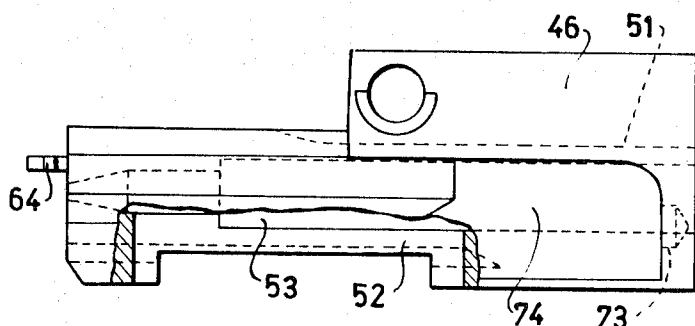


Fig. 11

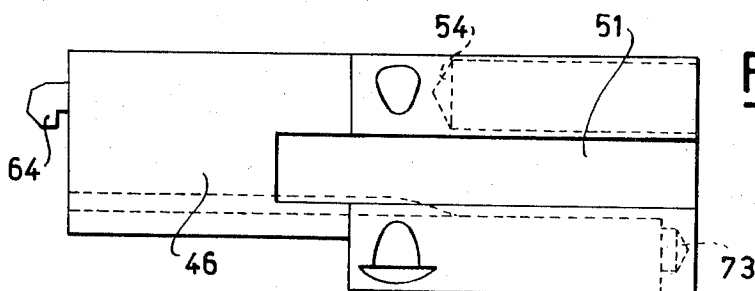


Fig. 12

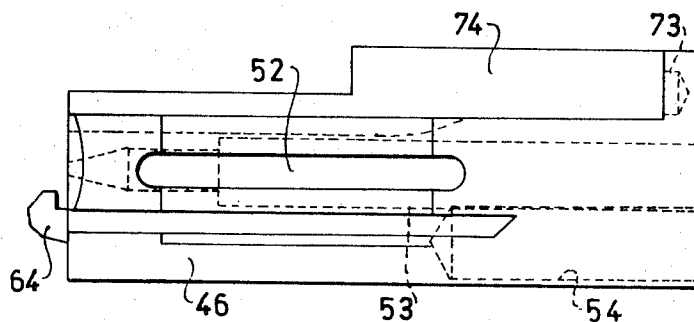


Fig. 13

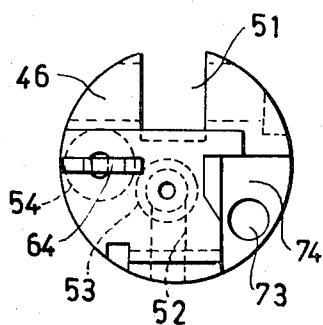


Fig. 14

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NAIL-DRIVING GUN

This invention relates to a tool for driving nails by exploiting an explosive action.

A particular object of the present invention is to provide a mechanical adjustment for any desired length of nail. Another object of the present invention is to provide an automatic locking action for the tool in combination with a safety device which prevents any actuation of the tool which is not expressly desired by the user.

In the nail-driving tools as used at present, there is an alternative choice between:

1. A shooting barrel with unobstructed muzzle in which the nail to be driven is in direct contact with the propelling charge and behaves just as a slug, or

2. A barrel which contains a pushing ram to strike the nail's head without any possibility of adjusting the length of the barrel or the initial position of the ram as a function of the individual nail to be driven.

In the former case the nail, being driven into the piece to be nailed, impinges thereon with an extremely high momentum which could be such as to originate substantial damage to the surrounding surface of the piece.

In the latter case, as the nail length is varied, the ram, rather than thrusting the nail to drive it into the desired piece, has a hammerlike action which, in addition to giving quite unsatisfactory results, could give rise to the same troubles experienced for the unobstructed barrel nail-driving tools.

An essential prerequisite for the tools of the kind referred to is absolutely to exclude any possibility that the tool may be actuated accidentally, for obvious reasons of safety. In this connection it can be recalled that standard specifications in several countries rule that the tool, to be allowed to function, should be pressed against the piece to be nailed with a force which is much higher than that which could be imparted to the tool accidentally. By way of indication, it can be said that the value of this force as prescribed by the Italian Standards is of about 2.5 times the tool weight.

This invention overcomes the drawbacks and disadvantages as briefly outlined above and provides, to this end, in a nail-driving gun the improvements comprising a telescopic adjusting member slidably mounted in the interior of the breech block and externally of the firing barrel and biased by a spring which reacts against an external annular projection formed by said firing barrel, a latch block mounted for rotation about said bolt and having a catch which engages in either of two notches formed on the rear end of the firing barrel, a cocking and trip lever having a rear tooth in nonpermanent engagement with the firing pin and having a front portion actuable by an actuating tooth of said trigger, said cocking and trip lever carrying out a rocking movement from the engagement position to the clearing position from said firing pin, and a spring which holds the bolt away of the breech-block bottom so that the front portion of the lever is shifted out of the active radius of said actuating tooth until a pressure is exerted which is sufficient to overcome the bias of the spring by shifting towards the breech plug the assembly comprising the telescopic adjustment member, the ram, the firing barrel, the bolt and the cocking and trip lever.

According to another aspect of the present invention, there is provided, in the interior of the adjustment telescopic member, a guiding tube for the front stem of the ram, said tube carrying at its front end a shock-absorbing member which is adapted to destroy any residual momentum possessed by the ram once a nail has been driven.

Another characteristic feature of the present invention is to provide a member for arresting the sliding motion of the telescopic adjusting member, said stop-member projecting annularly from the breech block so as to stop the sliding motion of the telescopic member when no nail to be driven has been fed in, before the barrel becomes engaged and is driven rearwards.

An additional feature of the nail-driving gun according to the present invention is the recoil-absorber provided between the breech block plug and the bottom of the bolt.

Other objects and advantages of the present invention will become apparent from the ensuing description, given by way of nonlimiting example only, reference being had to the accompanying drawings, wherein:

FIG. 1 is a side view, partly in section of the nail-driving gun according to the present invention;

FIG. 2 is a partial sectional view, in detail along the lines II—II of FIG. 1;

FIG. 3 is a detailed fragmentary view of the barrel of the nail-driving gun, removed from the gun;

FIG. 4 is a cross-sectional view taken along the line IV—IV of FIG. 3;

FIG. 5 is a fragmentary detail view of a portion of the nail-driving gun of FIG. 1;

FIG. 6 is a view similar to FIG. 1 of the gun in readiness for loading both the cartridge and the nail therein;

FIG. 7 is a view similar to FIG. 1 of the gun immediately before the actuation of the trigger;

FIG. 8 is a plan top view, partly in section, of the nail-driving gun taken along the line VIII—VIII of FIG. 6;

FIG. 9 is a side cross-sectional view of the breech block of the gun in the position of FIG. 7;

FIG. 10 is a cross-sectional view taken along the line X—X of FIG. 9;

FIG. 11 is a side view of the bolt only;

FIG. 12 is a plan top view of the bolt of FIG. 11;

FIG. 13 is a plan view, as viewed from below, of the bolt of FIG. 11 and

FIG. 14 is a view of the bolt as viewed from the left end in FIG. 11.

Having now initially reference to FIG. 1 and 8, the gun according to the present invention comprises a sound-deadening casing 1, whose purpose will be explained in more detail hereinafter, which is integrally affixed by riveting to a breech-block 3. The breech block, in correspondence with the sound-deadening casing 1 has helical peripheral ribs 4 which define a number of mutually communicating chambers 5 for the subsequent expansion of the explosion gases, the latter being ultimately discharged through the vents 6. At the rear end of the breech block 3, a breech-block plug 7 is provided which is screwably affixed to the breech block, a split elastic washer 8 being interposed to ensure a firm and permanent seal.

In the interior of the breech block plug a shock absorber 9 is provided for deadening possible recoil bumps by means a solid bottom disc 10.

At the opposite end of the breech block 3 projects a tubular telescopic adjustment member 11 which can be adjusted to the length of the selected nail, and whose operability will be discussed hereinafter. This member, which will be simply called "the telescope" hereinafter, is adapted to slide axially in the interior of the breech block 3, against the bias of a spring 12. The interior of the breech block 3, moreover, has a stepped annular safety abutment 13, intended for a purpose to be specified later. Within the telescope 11 and the breech block 3 the barrel proper 14 extends, which has an outside diameter such as to slide in the telescope 11 and which exhibits an annular projection 15: the latter is the seat of the adjustment spring 12, which is idly mounted around the external surface of the barrel, the opposite end of the spring being engaged by the adjusting telescope 11 as aforesaid.

At its end close to the breech block plug 7, the barrel 14 has an integral detent and latching member 16 having two notches 17 and 18 of different depths and terminates a catch 19, for a purpose to be specified hereinafter. In addition, the barrel 14 forms a cartridge chamber 20 which is loaded, whenever necessary, with a cartridge 21 of the kind conventionally used in tools of the kind referred to herein. The cartridge chamber 20 is in communication with a cavity 22 in which a thrust ram 23 is slidably housed, the stem 24 of the ram being guided by a guiding tube 25 which slidably extends in the adjustment telescope 11 and the barrel 14. In the front portion of the guiding tube 25 there is a disc 26 which is the seat for a shock absorber 27, preferably of solid rubber. As clearly shown in FIGS. 2, 3 and 4, the barrel 14 has two diametrically opposed

slots 28. The guiding tube 25 has two diametrically opposed bores 29 the adjustment telescope 11 has two coupling slots 30, also diametrically opposed. In FIG. 2 it can be seen that the barrel 14, the guiding tube 25 and the adjustment telescope are transversally connected by two diametrically opposed stop dowels 31, each of which has an extension 32 housed in its attendant bore 29, whereas the elongated body portion 33 is seated in the respective slot 30 of the telescope 11 and is allowed to slide in the slot 28 of the barrel 14. The foregoing description makes it clear that the arrangement described above is such that both the telescope 11 and the guiding tube 25 are allowed axially to slide with respect to the barrel 14 and the breech lock 3.

To load and eject the cartridge, the breech block 3 has an opening 34 (see FIG. 8) placed on a side, and to which corresponds an opening 35 formed through a sleeve 36 which carries the grip or butt 37 (FIG. 1). The latter has an appropriate housing for a trigger 38 having a catch 39 adapted to pivot about a pin 40.

On the top of the breech block 3 a slot 41 is formed to which corresponds a slot 42 in the sleeve 36, and in which a latch block 43 can be vertically oscillated. The block is connected by means of a pin 44 both with the breech block 3 which has a specially provided through-slot 45 (FIG. 5) and with the bolt 46 to be described hereinafter.

The latching block 43 has a cavity 47 to house a spring 48 which seats against the top face of the bolt 46. In addition, a screw-threaded stop dowel 49 is affixed to the latching block 43, and can be vertically screwed or loosened, for limiting the rotation of the block 43 about the pin 44 by acting against the top face of the bolt 46.

As clearly shown in FIG. 1, the latching block 43 engages by the agency of a tooth 50 the end 16 of the barrel 14 and, more exactly, in the closure position of the gun, it engages the deeper notch 17 whereas in the position in readiness for loading the cartridge (FIG. 6) it engages the notch 18. It should be observed that the tooth 19 of the end of the barrel 14 projects upward to the extent which suffices to prevent its being over-ridden by the catch 50 of the latching block 43 when the stop dowel 49 is fully screwed into the block.

The bolt 46, best shown in FIGS. 9 to 14, comprises a cylindrical body through which two diametrically opposed slots 51 and 52 have been formed along with two bores 53 and 54, of which the bore 53 is a through bore and is open at its bottom portion towards the slot 52. The blind hole 54 (FIG. 8) affords a seating for a spring 55, whose task will be explained hereinafter, whereas the bore 53 houses the firing pin 56 which comprises a top 57 (see FIG. 6) and a broadened cylindrical body 58 urged by a spring 59, the latter being guided by a pivot 60. Lastly, the top slot 51 houses the latching block 43, pivoted between the sides of the slot.

In its front portion, the bolt 46 has a planar face adapted to match the lower planar surface of the end 16 of the barrel 14, and an extractor 61 (FIG. 8), urged by a spring 62 housed in a hole 63 formed in the bolt body. The extractor 61 is intended to catch by tooth 64 the rim 65 of the cartridge casing 21 which has just been fired, for automatically ejecting the spent shell. The bolt 46 is associated with a cocking and trip lever 66 (FIGS. 6, 7, 8, 9 and 10) comprising a U-shaped front portion 67 which positions itself in the position clearly shown in FIG. 1, that is, shifted about 4 millimeters forward with respect to the tripping tooth 39 of trigger 38.

The rear portion of the lever 66 carries a cocking and trip tooth 68 (FIGS. 9 and 10) which is seated in the groove 52 and partially occupies also the bore 53, engaging in it by resting on the front end of the broadened body portion 58 of the firing pin 56, against the bias of the spring 59.

Laterally with respect to the lever 66 an eyelet 69 protrudes (FIGS. 9 and 10) in which is slidably housed a guiding rod 70 for a spring 71, whereas the opposite end 72 of the rod 70 (forming the fixed abutment for the spring 71) is housed in a recess 73 formed in the bolt body and which is the end of a hollow longitudinal portion 74 of the bolt so as to receive the

rod 70, the spring 71 and the eyelet 69 without departing from the circular outline of the bolt. Lastly, the lever 66 has a projection 75 which automatically ejects the spent shell after the same has been pulled out by the extractor 61.

It should be noticed, moreover, that both the spring 59 and the spring 55 bias the bottom disc 10 which is held in position by the breech block plug 7. In addition, FIG. 1 clearly shows that the rear face 76 of the bolt 46 is kept spaced from the disc 10 by the same distance existing between the front portion 67 of the lever 66 and the actuating tooth 39 of the trigger 38, that is to say, by 4 millimeters approximately, by the agency of the spring 55.

It should be observed, lastly, that the shock absorber 9, which has been shown as a spring in the drawings, can be of any kind, preferably solid rubber, which, in addition, is less prone to transfer recoil movements to the breech block plug 7. Furthermore, the barrel 14 has vent channels 77 for the explosion gases, said channels being in communication, as a cartridge is being fired, with channels 78 formed through the breech block 3 and which open in the interior of the chambers 5 of the silencer 1.

Considering now the operation of the nail-driving gun according to the present invention, the starting position is the one of FIG. 6, wherein the gun is in its at rest condition with the tooth 50 of the latching block 43 engaged by the notch 18, and the barrel 14 is in its foremost position. The specially provided cartridge 21 is introduced in the cartridge chamber through the openings 34 and 35. Then, by exerting a pushing action on the adjustment "telescope" 11, the barrel 14 is drawn backward until its notch 17 engages the tooth 50 of the latching block 43 against the bias of the spring 12 taking the configuration of FIG. 1.

At this stage, a nail 79 is slipped into the front opening of the adjustment telescope 11 so that the nail head 80 is positioned internally by using a plastics washer 81 as a centering device for the nail. Then, the muzzle of the gun is pressed against the piece to be nailed and a gradual compressive force is exerted in the direction of the arrow 82 in FIG. 7. The adjustment telescope slides in the interior of the breech block 3 until the nail head 80 contacts the front end of the stem 24, whereas the guiding tube 25 slides concurrently with the telescope 11 by virtue of the connection formed by the stop dowels 31. At this stage, by continuously pressing the handle 37 in the direction of the arrow 82, the ram 23 slides until it is positioned against the cartridge chamber 20, in which the cartridge 21 is contained. Due to the engagement relationship which has thus been established with the barrel 14, the latter starts to slide in the interior of the breech block 3 against the bias of the spring 55. By continuing to press the bias can be overcome until the bottom 76 of the bolt 46 contacts the disc 10 (position of FIG. 7). Simultaneously, the front portion 67 of the cocking and trip lever 66, by being moved with the bolt 46, becomes aligned with the trip tooth 39 of the trigger 38. Thus the gun, which had been switched from the position of FIG. 6 to that of FIG. 1 as soon as the head 23 of the ram had engaged the barrel 14, has reached the position shown in FIG. 7 in which it is in readiness for firing. It is important to recall that the condition of FIG. 7 is maintained only when the pressure overcoming the bias of the spring 55 is kept constant. At this stage, by pressing the trigger 38, the tooth 39 urges the front end 67 of lever 66 upward so that the lever, by being moved as a rocker, clears the tooth 68 from the firing pin 56 and the latter snaps under the urge of the spring 59 and strikes the rim of the cartridge 21, which is fired.

Subsequently, the explosion gases, acting in the interior of the cartridge chamber 20, thrust with desired intensity the ram 23 forward and the latter, through its stem 24, shoots the nail 79 causing it to pierce the piece to be nailed;

Then the gun is withdrawn from the piece which has been nailed and the latching block 43 is lifted so that the barrel 14, under the bias of the spring 12, is thrust forward and frees the openings 34 and 35. Meanwhile, the extractor 61 had engaged, with its tooth 64, the rim 65 of the cartridge casing

which was still in the cartridge chamber 20, so that the casing 21 does not follow the movement of the barrel. At the same time, by virtue of the bias of the spring 71 which becomes distended, the cocking and trip lever 66 is thrust forward and engages, along its stroke, the rim of the casing 21 with the ejector 75 which is placed in a position which is diametrically opposed to that of the extractor 61, so that the casing undergoes a side thrust and is thus expelled from the barrel, the breech block and the sleeve 36 through openings 34 and 35.

While this is occurring, the cocking and trip tooth 68 brought to the front end of the lower slot 52 of the bolt 46 in a position in readiness for engaging the broadened body portion 58 of the firing pin 56. As soon as the barrel 14, as outlined above, is brought back until the new cartridge 21 is latched in position in the cartridge chamber 20, the lever 66 is pulled back again and, through the eyelet 69, compresses the spring 72 whereas the tooth 68 cocks the firing pin once more.

It is important to emphasize the fact that, if no nail is present, the cartridge 21 cannot be fired. As a matter of fact, by exerting a pressure on the adjustment telescope 11, the latter meets, during its stroke, the annular catch 13 before the barrel 14 can be engaged and slid so as to bring the bottom 76 of the bolt against the disc 10 and the front portion 67 of the lever 66 to a position adapted to permit the actuation of the trigger 38 by the tooth 39 thereof.

Another significant feature consists in the fact that at the front end of the guiding tube 25 a shock absorber 27 is provided; as a matter of fact, if the nail, while being driven encounters a resistance which is much less than that which had been forecast, the nail itself is not only detached from the front end of the stem, but the stem 24 terminates its forward stroke while still possessing a high momentum. The momentum is transferred to the guiding tube 25 by virtue of the engagement of the ram 23 with the rear end of the tube, and is dissipated thereby in the shock absorber mentioned above.

While the invention has been described in the foregoing in connection with a preferred embodiment thereof, it is to be understood that a number of modifications and changes, which are equivalent from both a mechanical and conceptual standpoint, can be introduced therein without departing from the scope of the invention, said changes and modifications being an integral part of the invention as defined in the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A nail-driving gun, comprising a breech block, having a lateral opening therein for introducing a cartridge into the gun, a barrel housed in the breech block and forming a cartridge chamber, a ram slidable in said barrel and on which the explosion gases generated in the cartridge chamber are active, a bolt movable in the breech block, a firing pin movable in a bore of the bolt, a spring urging the firing pin forwardly relative to the bolt to firing position, an adjustable telescopic member slidably mounted in the interior of the breech block and externally of the barrel, a first compression spring acting on said telescopic member to thrust it towards the front end of the gun and interposed between said telescopic member and

an outer annular protrusion formed on said barrel, a guiding tube for said ram housed in the interior of the telescopic member and barrel, said barrel having two longitudinal diametrically opposed slots, two stop dowels connecting said telescopic adjustment member and said guiding tube and slidable in said slots of said barrel, a latching block pivotally connected to said bolt and having a locking tooth, the rear end of said barrel having two transverse notches adapted to be engaged by said locking tooth, said bolt having a longitudinal groove in free communication with the bore for the firing pin, a cocking and trip lever having a cocking and tripping tooth projecting from its rear end and seated in said groove of said bolt so as to project into said firing-pin bore, means releasably connecting said cocking and tripping tooth and said firing pin, said lever having a U-shaped front portion, a trigger having an actuating tooth engaging said front portion of said lever in the firing position, a second spring constantly urging said bolt and said lever to their foremost positions, said bolt having a blind hole therein, a third spring seated in said blind hole, a bottom disc, against which said spring presses, a breech block plug mounted in said breech block to retain said bottom disc in position, extractor means on said bolt to engage the rim of the cartridge in said cartridge chamber, and cartridge casing ejecting means on said lever for ejecting the casing engaged by said extractor means.

2. A nail-driving gun according to claim 1, having a spring urging said latching block towards latching position, an adjustable dowel threaded into said latching block adjustably to limit the pivotal movement for opening said latching block, the rearmost notch of said two notches having a rear edge which projects by a height which is greater than that by which the locking tooth of said latching block can be lifted relative to the notch when said adjustable dowel is adjusted to its maximum extension from the latching block.

3. A nail-driving gun according to claim 1, wherein an antirecoil absorber is seated between said bottom disc and said breech block plug.

4. A nail-driving gun according to claim 1, wherein a shock absorber is provided between said guiding tube and said telescopic adjustment member.

5. A nail-driving gun according to claim 1, wherein said releasable connecting means between the firing pin and the cocking and tripping tooth comprises a protrusion jutting from the firing pin body and which is adapted to be engaged by said cocking and tripping tooth.

6. A nail-driving gun according to claim 1, wherein a silencing sleeve is provided around the breech block, said sleeve having its front end venting holes for the explosion gases, and internal ribs forming intercommunicating chambers for expansion of the explosion gases, and said barrel has holes for connection with the first of said expansion chambers.

7. A nail-driving gun according to claim 1, wherein said breech block has internally a stepped abutment for said telescopic adjustment member, and said abutment is placed from the rear end of the telescopic member, when the recoil spring is completely distended, a distance which is shorter than the length of the slots formed through said barrel.

* * * * *