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**Compact firearm**

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ABSTRACT

A compact firearm having a split bolt in the form of a main bolt and a bolt extension. The bolt extension is mounted forward of the bolt for  
5 reciprocating motion generally parallel to a longitudinal axis of the barrel.  
The bolt and bolt extension are connected by guides.



AUSTRALIA

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**ORIGINAL  
COMPLETE SPECIFICATION  
STANDARD PATENT**

Invention Title: "COMPACT FIREARM"

The following statement is a full description of this invention, including the best method of performing it known to me/us:

## "COMPACT FIREARM"

### FIELD OF THE INVENTION

The invention relates to a simple, lightweight, compact, robust firearm able to deliver automatic or semi-automatic fire.

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### BACKGROUND TO THE INVENTION

Firearms come in many different configurations including pistols, rifles, machine guns, sub machine guns etc. One line of firearm development has been towards lightweight, compact firearms capable of delivering a high volume of accurate fire. A variety of compact, automatic or semi-automatic weapons are known including the Uzi, the Heckler & Koch MP5K and the Ingram M10.

The Israeli built Uzi is a 9mm caliber weapon operating on the blowback method of operation. It has an unloaded weight of 3.5kg and a minimum length of 440mm. The Uzi can be fired fully automatic or semi-automatic. It is a very popular and effective weapon.

The German-made Heckler & Koch MP5K is also a 9mm caliber weapon operating on the blowback principle. It has an unloaded weight of 2.45kg and a minimum length of 325mm. The MP5K is normally available in a fully automatic configuration although semi-automatic operation is possible.

The Ingram M10 is manufactured in the United States with an unloaded weight of 2.72kg and a length of 267mm (without stock). It operates on the blowback principle and has a 9mm caliber. The weapon

may be fired automatic or semi-automatic.

All of the above weapons have found application in defense forces and civil security forces. The weapons are particularly useful for anti-terrorist or undercover work where the compact size and light weight renders the weapons readily concealable. Nonetheless, there is advantage in developing even lighter and more compact weapons provided the volume of fire and accuracy remains acceptable.

#### OBJECT OF THE INVENTION

It is an object of the present invention to provide a simple, compact, light, robust firearm.

Further objects will be evident from the following description.

#### DISCLOSURE OF THE INVENTION

In one form, although it need not be the only or indeed the broadest form, the invention resides in a firearm comprising:

a body;

a barrel mounted in the body and including a chamber for receiving rounds to be fired from the firearm;

a bolt mounted for reciprocating motion in the body such that, in use, the bolt collects a round from a magazine and delivers the round to the chamber;

said firearm characterized by a bolt extension mounted forward of said bolt for reciprocating motion generally parallel to a

longitudinal axis of the barrel with guides connecting the bolt and bolt extension.

In preference, the bolt extension is cylindrical in shape and is mounted coaxial with the longitudinal axis of the barrel.

5 The firearm will normally further comprise a receiver at an end of the barrel nearest the bolt and surrounding the chamber. A bolt return spring is suitably mounted between the bolt extension and the receiver. The guides are conveniently mounted to slide in apertures in the receiver such that the bolt, bolt extension and guides move together  
10 on an axis coaxial with the longitudinal axis of the barrel.

In preference the sear is mounted forward of the trigger so that the sear captures the bolt extension in a cocked condition.

The body is preferably moulded from plastics material in a single piece.

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### BRIEF DETAILS OF THE DRAWINGS

To assist in understanding the invention preferred embodiments will now be described with reference to the following figures in which :

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FIG 1 is a schematic of a firearm;

FIG 2 shows a partial cross-section exploded view of the working parts of the firearm of FIG 1 viewed from below;

FIG 3 shows one embodiment of a trigger

mechanism; and

FIG 4 shows one embodiment of a safety mechanism.

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### DETAILED DESCRIPTION OF THE DRAWINGS

In the drawings, like reference numerals refer to like parts.

Referring to FIG 1, there is shown a firearm, generally indicated as 1. The firearm 1 comprises a body 2 which, to reduce weight is made from moulded plastics material. The body 2 is fitted to a separate grip 3 which is also made from plastics material.

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The remainder of the parts of the firearm can best be described by reference to the cycle of operation of the weapon. A magazine 4 is loaded to the firearm 1 and secured with magazine catch 5. The cocking handle 6 is pulled to the rear thereby pulling the bolt 7 rearward. The bolt 7 is connected to bolt extension 8 by guides 9. A slot 10 in the underside of the bolt 7 engages a ridge 11 in the body 2 to guide the bolt rearward without rotation.

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As seen most clearly in FIG 2, there is a pair of guides 9a, 9b positioned either side of the barrel 12. For ease of viewing the barrel is the only element shown in cross-section. The bolt extension 8 moves coaxially over the barrel 12 against bolt return spring 13. Spring 13 is mounted coaxial with the bolt 7 and positioned between the bolt extension 8 and the receiver 14 of the barrel 12.

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Although the bolt extension is shown as coaxial with the

barrel it will be appreciated that the bolt extension could be positioned in some other orientation, such as above or below the barrel. In such case the body 2 would be shaped to constrain the motion of the bolt extension. The inventors have found that the coaxial arrangement is most convenient.

The cocking handle 6 is pulled to the rear and released, this allows the bolt extension 8 to move forward slightly until the sear 15 engages the catch 16 in the bolt extension 8. In this condition the firearm is cocked.

The structure of the working parts is seen most clearly in FIG 2. The guides 9a, 9b are threaded at one end 17 to screw into threaded apertures 18 in the bolt 7. The guides 9 pass through holes 19 in the bolt extension 8 and holes 20 in the receiver 14. Movement of the bolt 7 rearward causes the guides 9 to move rearward thereby pulling the bolt extension 8 rearward and compressing the spring 13. The sear 15 is positioned forward to capture the bolt extension 8. If desired, the cocking handle 6 can be returned forward thereby sliding the bolt 7 forward and closing the breach. Because the bolt extension 8 is held by the sear 15 it remains rearward in the cocked position and the spring 13 remains compressed.

When the trigger 21 is pulled, the sear 15 is drawn away from the catch 16 of the bolt extension 8 thereby allowing the bolt extension 8 to fly forward under influence of the spring 13. The bolt 7 is drawn forward due to the connection via the guides 9. The moving bolt 7



picks up the top round (not shown) from the magazine 4 and directs it towards the chamber 22. The feed ramp 23 guides the nose of the round into the chamber 22 thereby ensuring correct alignment of the round.

When the round is completely chambered, a lip at the front of the  
5 cartridge case engages the shoulder 24 terminating the inner end of the chamber.

The bolt 7 is formed with a fixed firing pin 25 positioned in the bottom of a recess 26. The recess is sized and shaped to fit over the rear of the cartridge. In this manner the firing pin cannot engage the  
10 primer of the cartridge unless the round is correctly positioned in the chamber. The final movement of the bolt 7 drives the firing pin 25 into the primer of the cartridge thereby detonating the round. The final movement of the bolt also allows the extractor 26 to slip into and grip the groove in the base of the cartridge (not shown) under the influence of spring 27.

15 After detonation of the primer, the force generated by the expanding gases in the cartridge case drives the bullet forward and exerts rearward pressure on the cartridge case to the bolt. At almost the same time and just before the bullet has left the barrel, gas is vented upwards through a small hole or holes 28 near the end of the barrel. The gas is  
20 vented into a gas chamber 29 formed in the rear of the bolt extension.

Venting the gas in this manner has two effects, the rearward movement of the bolt and bolt extension is retarded, and the jump or recoil of the firearm is compensated by the downward force of the venting gas. The jump compensation assists to maintain the aim of the firearm during

repeated firing.

The pressure of gas in the barrel overcomes the force of the spring 13, the inertia of the working parts (bolt, bolt extension and guides) and the dissipating gas in the gas chamber to force the bolt (and therefore the bolt extension and guides) rearward. This occurs well after the bullet has left the barrel and the chamber pressure has dropped to a safe level.

As the bolt starts rearwards the empty cartridge case is held in the recess in the bolt face by the extractor until the base of the cartridge hits the ejector 30 formed in the rear wall of the magazine. Even if the magazine is damaged, the round is ejected by the ridge 11. The empty case is ejected through the ejector port 30A formed in the body 2 of the firearm 1.

The bolt 7 continues to travel rearwards drawing the bolt extension 8 rearwards and compressing the spring 13. The sear 15 is depressed by the bolt extension 8 and then rises under influence of the sear spring 31 to engage the catch 16 on the bolt extension 8. The movement of the working parts rearward is slowed by the spring 13 and then forward movement again commences until checked by the sear engaging the catch 16. The firearm is cocked and ready for the next shot. If full automatic fire is required, the trigger is held continually and the firearm operates continuously at its cyclic rate of fire until the magazine is empty. If the trigger is released during firing, the trigger spring 32 acts to

raise the trigger 21 thereby releasing the sear 15 and capturing the bolt extension 8 in the cocked position.

After the last round leaves the magazine a magazine follower (not shown) rises to a level that prevents the forward movement of the bolt. An empty magazine therefore results in an open breach condition to show the user that the magazine is empty.

The split bolt design of this firearm allows for even more compact weapons than has previously been possible. The inventor has constructed a firearm that is capable of fully automatic or semi automatic fire in 9mm caliber that has an overall length of 178mm. With the use of plastic for the majority of the parts, the total unloaded weight is only 1kg. Yet, the performance and accuracy are similar to heavier and longer weapons.

The described embodiment has thirty-one parts. The majority of the thirty-one parts in the firearm are formed from plastics material. The small number of parts is partly achieved by developing a single piece body in which many parts, such as the sights, are formed with the body. The only metal components are the barrel, receiver, bolt, bolt extension, guides, springs, trigger, and sear. In fact, with suitable choice of material, the trigger, receiver and perhaps other components may be non-metal. All other parts are made, or can be made, from plastic. A variety of plastics will be suitable providing they exhibit appropriate thermal, chemical and impact resistant properties. The use of plastics ensures minimum weight for the firearm.

The trigger mechanism can be modified for semi-automatic and full-automatic operation. For example, the portion of the trigger engaging the sear can be modified in the manner shown in FIG 3, to allow both automatic and semi-automatic operation. A first pressure on the trigger 21 will be sufficient to depress the sear 15 and release the bolt extension 8. However, the arced movement of the trigger 21 on pivot 33 causes lip 34 to slide past the leg 35 of sear 15. This allows sear 15 to rise under influence of spring 31 and catch the bolt extension 8 for semi-automatic operation.

A greater pressure on trigger 21 will bring head 36 into contact with leg 35. Because of the greater overlap of head 36 on leg 35, the sear 15 is held down as long as the trigger 21 is depressed, for automatic operation.

Other mechanisms for controlling the rate of fire will be evident to those skilled in the art.

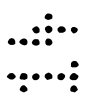
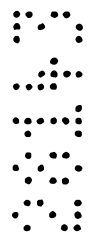
Although not described in detail above, the firearm will include a safety catch which blocks the cocking handle to prevent inadvertent firing. One other arrangement evident to the inventor is forming an eccentric cocking handle 6, as shown in FIG 4. The cocking handle 6 is rotatable between a fire position (as shown) and a safe position in which the cam 37 engages the body 2. In this position the bolt 7 cannot move fully forward so the firing pin 25 cannot strike the primer.

It will be appreciated that the principle of deploying a bolt extension forward of the receiver can be applied to most firearms and is

not limited to the particular embodiment described herein.

Throughout the specification the aim has been to describe the preferred embodiments of the invention without limiting the invention to any one embodiment or specific collection of features.

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A firearm comprising:

a body;

a barrel mounted in the body and including a chamber for  
5 receiving rounds to be fired from the firearm;

a bolt mounted for reciprocating motion in the body such  
that, in use, the bolt collects a round from a magazine and delivers the  
round to the chamber;

said firearm characterized by a bolt extension mounted  
10 forward of said bolt for reciprocating motion generally parallel to a  
longitudinal axis of the barrel with guides connecting the bolt and bolt  
extension.

2. The firearm of claim 1 wherein the bolt extension is generally  
cylindrical in shape and is mounted coaxial with the longitudinal axis of  
15 the barrel.

3. The firearm of claim 1 further comprising a receiver at an end of  
the barrel nearest the bolt and surrounding the chamber.

4. The firearm of claim 3 further comprising, a bolt return spring  
mounted between the bolt extension and the receiver.

20 5. The firearm of claim 3 wherein the guides are mounted to slide in  
apertures in the receiver such that the bolt, bolt extension and guides  
move together on an axis coaxial with the longitudinal axis of the barrel.

6. The firearm of claim 1 further comprising a sear mounted forward of a trigger so that the sear captures the bolt extension in a cocked condition.

5 7. The firearm of claim 6 wherein the trigger incorporates a lip that releasably depresses the sear for semi-automatic operation and a head that depresses the sear for automatic operation.

8. The firearm of claim 1 wherein the body is moulded from plastics material in a single piece.

10 9. The firearm of claim 1 further comprising an eccentric cocking handle rotatable between a fire position and a safe position.

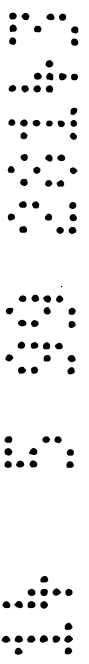
DATED this eleventh day of May 1999

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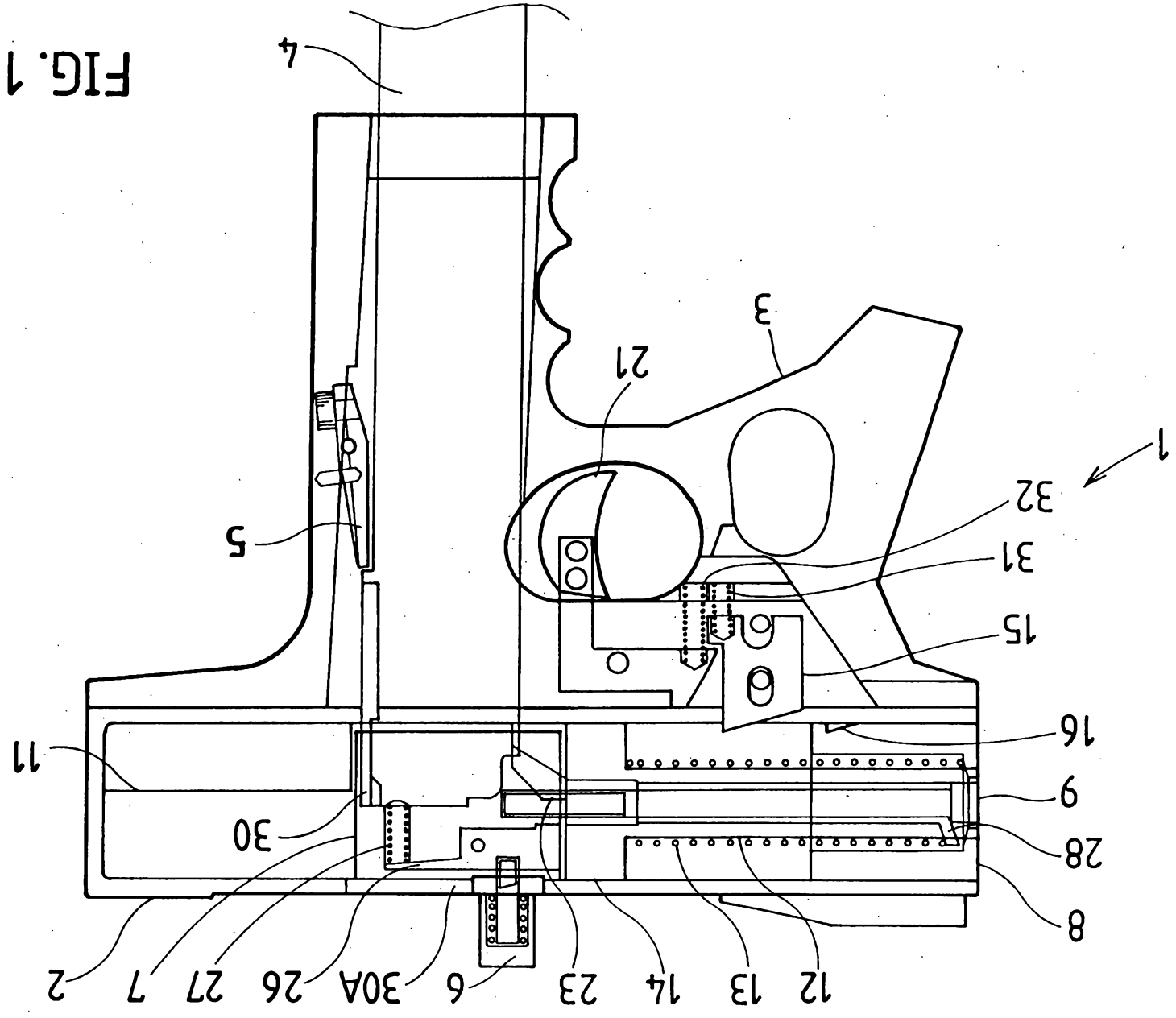
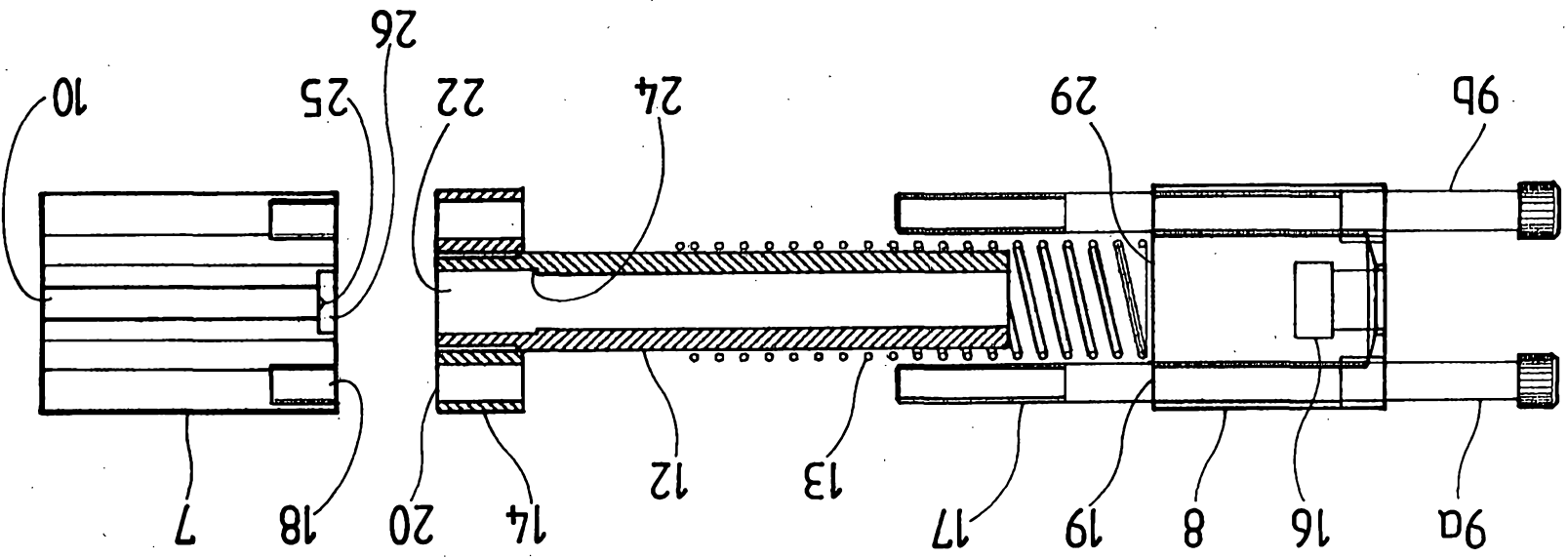




FIG. 2



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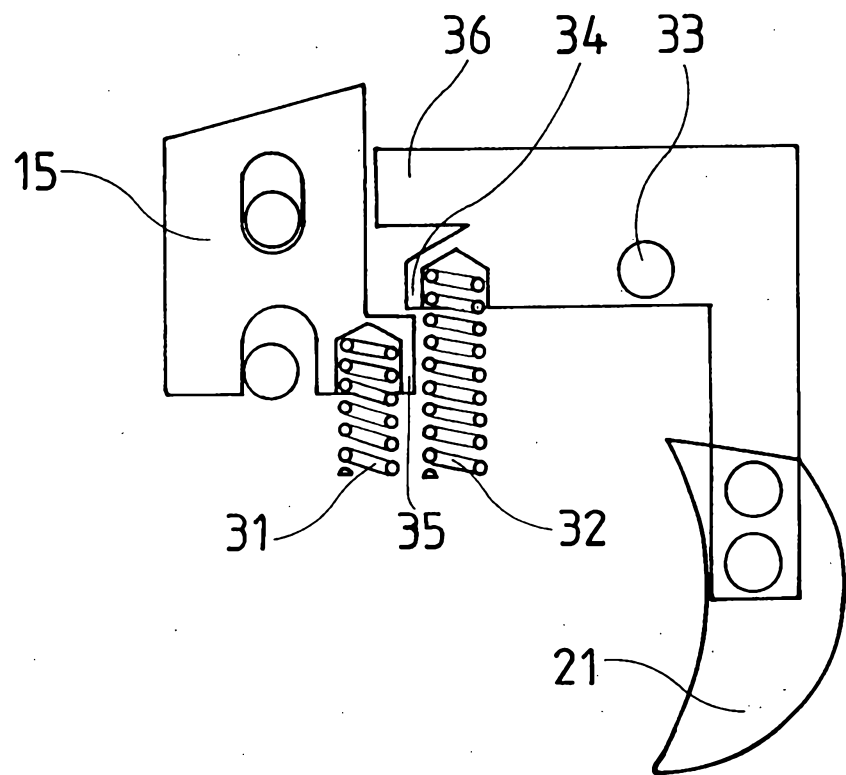


FIG. 3

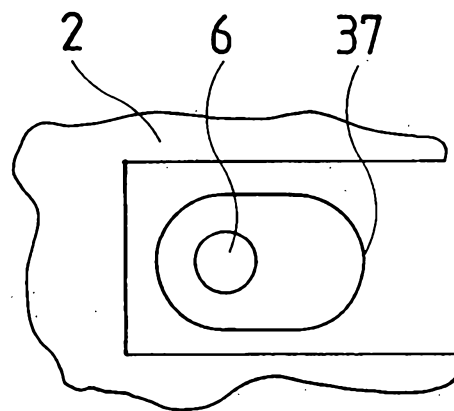


FIG. 4