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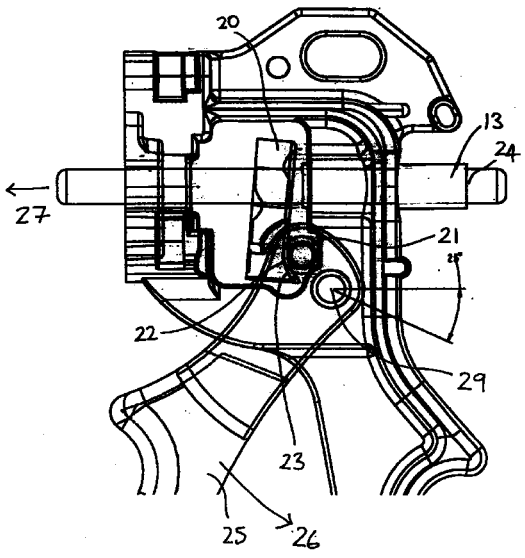
## (54) Push rod actuator mechanism

(57) A lever-operated device for applying pressure by means of a push rod (24) can be provided with a means (20) for engaging the push rod that is shaped to increase the translocation of the push rod (24) that can be achieved when the lever (25) is operated. The means (20) for engaging the push rod (24) may have a sloped or curved surface, against which part of the lever bears.

Fig. 2

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## Description

**[0001]** The present invention relates to push rod actuator mechanisms. Such devices are useful (*inter alia*) for dispensing material from a container and for clamping purposes.

**[0002]** Dispensing guns for applying pressure by means of a push rod are well known. The push rod will usually be mounted to a frame for slidable motion and the device can be operated by pressing a pivotally mounted trigger lever. A cross member part of the lever (which may be in the form of a stud or rivet, for example) is arranged at a distance from the pivot point to bear against a catch plate that engages the push rod so as to transfer some of the pivotal motion generated by squeezing the trigger into axial movement of the push rod. In this way the trigger movement advances the push rod. The catch plate may be normally biased into engagement with the push rod or it may be biased out of engagement and only engaged by initial movement of the trigger.

**[0003]** Such mechanisms often have a large mechanical advantage since the trigger needs to be operated across a large arc to convert the force applied to the trigger by the hand into a sufficiently greater force on the push rod.

**[0004]** It has been recognised by the inventor that the start of the trigger stroke is near the point on the arc of travel of the cross member where the movement is mostly parallel with the direction of travel of the push rod. As the stroke progresses, however, the movement can be resolved into an increasingly large component at right angles to the travel of the push rod and concommittantly less in the direction of travel. The movement of the trigger is increasingly less effective in advancing the push rod. Towards the end of a trigger stroke the trigger is all but ineffective in achieving advance of the push rod.

**[0005]** According to the present invention there is provided a push rod actuator mechanism, comprising a push rod, engagement means for releasably engaging the push rod and trigger means pivotable between first and second positions, the trigger means having a first surface that engages a second surface on the engagement means when the trigger is pivoted to advance the push rod, the first surface following an arcuate path such that the first surface moves across the second surface, at least one of the first surface and the second surface being adapted to adjust the mechanical advantage of the mechanism as the trigger is pivoted between the first and second positions.

**[0006]** The arcuate path followed by the first surface of the trigger means is notionally resolvable into movement along the direction of advance of the push rod and movement orthogonal to the said direction. Thus, one of the first and the second surfaces can be adapted to adjust the mechanical advantage, as the resolved movements along and orthogonal to the push rod advance vary and, preferably, provide a more uniform mechanical advantage for the system for the movement of the trigger. In prior art devices the mechanical advantage increase as the trigger progresses through its arc because of the increasing orthogonal component of movement of the first surface.

**[0007]** It will be appreciated that a varying mechanical advantage is possible according to the profile of the second surface, but the main use to which the invention is likely to be put is to even out the mechanical advantage of the mechanism along the extent of travel of the trigger means.

**[0008]** The present invention may allow a push rod to be displaced to a significantly greater degree than can be achieved with a prior art device when the trigger is pivoted through a given angle because the shape of the second surface can be adapted to translate movement of the first surface into axial movement of the push rod. In one embodiment it has been found that the push rod can be displaced by an additional 33% relative to such a prior art device for the same trigger arrangement.

**[0009]** The adapted surface, e.g. the second surface, may extend in the form of a linear slope. The slope can be set at any appropriate angle to a plane lying orthogonal to the axis along which the push rod moves. Preferably this angle is from 10 to 25 degrees. More preferably it is 17.5 degrees.

**[0010]** Alternatively, the adapted surface may be in the form of a curve. Preferably the curve is convex. The curve may be arcuate or follow another profile.

**[0011]** The first surface is preferably also curved. It may be the outer surface of a generally cylindrical part of the lever, for example it may be the outer surface of a cross member, e.g. a stud or rivet. However it need not be present on the trigger itself. It may be a surface of a component operatively connected with the trigger and positioned between the trigger and the engagement means.

**[0012]** The present invention may be adapted to be dispensing mechanism for a dispenser which holds a cartridge of material and dispenses material from such a cartridge in a controlled manner by actuation of the trigger. The material to be dispensed will usually (although not necessarily) be a viscous material - e.g. glue, paste, mastic, putty and the like. A cartridge from which material is to be dispensed can have any shape, but is preferably generally cylindrical single or multiple container dispenser can be actuated by the present invention.

**[0013]** In a further embodiment the invention may be adapted to form part of a clamp - e.g. a "G clamp" in which the push rod is operatively connected with one of the jaws, the other jaw being fixed to a clamp frame to which the mechanism is also mounted.

**[0014]** In whatever form it is provided, it is preferred that the present invention also comprises brake means which prevent the advanced rod from being retracted. By releasing the brake the push rod is then retractable. The brake

means may be releasable also to release the engagement means from engagement with the rod. It may alternatively be part of an actuator in which the engagement means are not normally engaged with the rod if the trigger is not actuated.

**[0015]** Although the foregoing description of the invention concentrates upon the mechanism, it is important to note that the invention also includes within its scope an engagement means suitable for use in such a device. The engagement means can be sold separately as a spare part. It can be used to replace a prior art engagement means in order to improve the efficiency of a prior art device.

**[0016]** The present invention will now be described by way of example only, with reference to the accompanying drawings, wherein:

Figure 1 illustrates a dispenser gun according to the invention;

Figure 2 illustrates a first embodiment of the actuator mechanism of the present invention;

Figures 3 and 4 illustrate the dispenser gun shown in Figure 2 with its lever at more advanced positions than shown in Figure 2;

Figure 5 is a plot of the data shown in Table 1 for the dispenser gun shown in Figures 2 to 4;

Figure 6 illustrates a second embodiment of an actuator mechanism of the present invention;

Figures 7 and 8 illustrate the dispenser gun shown in Figure 6 with its lever at more advanced positions than shown in Figure 6;

Figure 9 is a plot of the data shown in Table 2 for the dispenser gun shown in Figures 6 to 8;

Figures 10 and 11 illustrate the catch plate of the dispenser gun shown in Figures 6 to 8.

**[0017]** Referring to Figure 1, a dispenser gun is shown. The gun comprises a barrel 1 that contains material to be dispensed. At one end it has a nozzle assembly 2 and at the other end it has an operating mechanism 3, by means of which a push rod 24 can be advanced in a step-by-step manner along the axis of a barrel 1. The operating mechanism comprises a stock 5 defining front and rear bores that constrain the rod to axial movement It also comprises a depending handle 6 that can be grasped by a hand of an operator. A trigger-like lever member 25 is pivotally mounted to the handle 6. On the side of a pivot 29 of the trigger 25 remote from a finger-engaging portion 9 thereof is a circular section stud 21 that engages an apertured catch plate 20 through which aperture the rod 24 passes with clearance. The plate 20 is biased into engagement with the rod by means of a biasing spring 14 which urges the the plate rearwards against the stud 21 so that it is corked in engagement with the rod 24. The rod also passes through an apertured brake plate 15, which plate engages against a boss 16 on the stock 5 and which is biased to the right, also into engagement with the rod, as seen in the drawing by means of a spring 17.

**[0018]** When the trigger member 25 is squeezed towards the handle 6, the stud 21 moves the catch plate 20 forward as soon as the lever is advanced because it is biased into engagement with the rod by the spring. On continued squeezing of the trigger member 25, the plate 20 moves forward with the rod to advance a piston (not shown) in the barrel 1. During this forward movement of the rod 24, the rod slides through the brake plate 15 which is tilted slightly about the boss 16 to allow free forward movement of the rod 24 through the aperture of the brake plate. On release of the trigger member 25, the spring 14 returns the plate 20 to the position shown in Figure 1. The rod 24 is prevented from moving in the reverse direction by the brake plate 15 resuming the rod engaging position shown in Figure 1 and gripping the rod 24. The return movement of the plate 20 under the action of the spring 14 also returns the trigger member 25 to the position shown.

**[0019]** Depressing the brake plate 15 to release the mci also causes a sleeve 13 on the rod to move forwards to tilt the plate 20 upright and out of engagement with the rod so that the rod can be retracted by puffing on the rear most end of the rod. This sleeve 13 is shown in Figure 2 but is omitted from the other drawings for the sake of clarity.

**[0020]** In Figure 2 a part of a dispenser gun of the present invention is shown. It can be seen more clearly that, in contrast to conventional dispenser guns, the dispenser gun has an engagement means in the form of a catch plate 20 that has a curved profile to its rear surface 23 arranged for engagement with a bearing surface 22 of a stud 21. The curved profile to its rear surface 23 is concave and, when viewed from the top towards the bottom of the figure, it can be seen to extend in the opposite direction to that in which the push rod 24 is advanced to apply pressure. As an operator rotates the trigger 25 about the pivot 29 in the direction indicated by arc 26, the stud 21 travels first forwardly and then increasingly downwardly along the curved surface 23, causing the push rod engaged by the catch plate 24 to

advance in the direction indicated by arrow 27.

**[0021]** Figure 3 is similar to Figure 2 but shows the stud 21 at a position in which it has travelled further along the curved surface 21 of the catch plate 20. Here the push rod 24 will have advanced further along the direction indicated by arrow 27.

**[0022]** Figure 4 shows the stud 21 after it has travelled still further along the catch plate 20. At the position shown lever 25 has come to a stop because it abuts the handle 28. The trigger 25 can be released at this position and biasing means in the form of the spring 14 urges the catch plate 20 back along the push rod 24 which is braked by the brake plate 15 to return the catch plate 20 and tie trigger 25 to their original positions. The brake plate holds the push rod in the position reached by actuation of the trigger.

**[0023]** Thus, the potentially increasing mechanical advantage afforded by the arc followed by the stud 21, i.e. increasingly away from the direction of advancement of the rod 24, is compensated for by the profile of the tail of the catch plate.

**[0024]** Figure 5 is based upon the data shown in Table 1 below.

**Table 1**

| TRIGGER ANGLE DEGREES | REF. DISTANCE | PUSH ROD MOVEMENT |
|---|---|---|
| 35 | 34.37 | 0 |
| 34 | 34.22 | 0.27 |
| 33 | 34.06 | 0.43 |
| 32 | 33.91 | 0.58 |
| 31 | 33.76 | 0.73 |
| 30 | 33.61 | 0.88 |
| 29 | 33.46 | 1.03 |
| 28.4 | 33.37 | 1.12 |
| 28 | 33.31 | 1.18 |
| 27 | 33.16 | 1.33 |
| 26 | 33.02 | 1.47 |
| 25 | 32.88 | 1.61 |
| 24 | 32.71 | 1.78 |
| 23 | 32.59 | 1.9 |
| 22 | 32.46 | 2.03 |
| 21 | 32.33 | 2.16 |
| 20 | 32.2 | 2.29 |
| 19 | 32.06 | 2.43 |
| 18 | 31.93 | 2.56 |
| 17 | 31.79 | 2.7 |
| 16 | 31.65 | 2.84 |
| 15 | 31.5 | 2.99 |
| 14 | 31.35 | 3.14 |
| 13 | 31.2 | 3.29 |
| 12 | 31.05 | 3.44 |
| 11 | 30.89 | 3.6 |
| 10 | 30.79 | 3.7 |
| 9 | 30.55 | 3.94 |
| 8 | 30.38 | 4.11 |
| 7 | 30.19 | 4.3 |
| 6 | 30 | 4.49 |
| 5 | 29.8 | 4.69 |
| 4 | 29.59 | 4.9 |
| 3 | 29.43 | 5.06 |
| 2 | 29.13 | 5.36 |
| 1 | 28.88 | 5.61 |

| | | |
|---|---|---|
| 0 | 28.64 | 5.85 |
| -1 | 28.42 | 6.07 |
| -2 | 28.22 | 6.27 |
| -3 | 28.04 | 6.45 |
| -4 | 27.86 | 6.63 |
| -5 | 27.71 | 6.78 |
| -6 | 27.56 | 6.93 |

**[0025]** Figures 6 shows a dispenser gun that is generally similar to the dispenser gun shown in Figures 2 to 4, with the exception that the catch plate 20 has an flat angled profile to its rear surface 30. Figures 7 and 8 show the stud 21 at different positions along the angled surface 30.

**[0026]** Figure 9 is based upon the data shown in Table 2 below.

**Table 2**

| TRIGGER ANGLE DEGREES | REF. DISTANCE | PUSH ROD MOVEMENT |
|---|---|---|
| 35 | 34.49 | 0 |
| 34 | 34.31 | 0.18 |
| 33 | 34.14 | 0.35 |
| 32 | 33.97 | 0.52 |
| 31 | 33.79 | 0.7 |
| 30 | 33.63 | 0.86 |
| 29 | 33.46 | 1.03 |
| 28.4 | 33.36 | 1.13 |
| 28 | 33.29 | 1.2 |
| 27 | 33.12 | 1.37 |
| 26 | 32.96 | 1.53 |
| 25 | 32.79 | 1.7 |
| 24 | 32.63 | 1.86 |
| 23 | 32.47 | 2.02 |
| 22 | 32.31 | 2.18 |
| 21 | 32.15 | 2.34 |
| 20 | 31.99 | 2.5 |
| 19 | 31.84 | 2.65 |
| 18 | 31.69 | 2.8 |
| 17 | 31.54 | 2.95 |
| 16 | 31.39 | 3.1 |

| | | |
|---|---|---|
| 15 | 31.24 | 3.25 |
| 14 | 31.1 | 3.39 |
| 13 | 30.95 | 3.54 |
| 12 | 30.81 | 3.68 |
| 11 | 30.67 | 3.82 |
| 10 | 30.54 | 3.95 |
| 9 | 30.4 | 4.09 |
| 8 | 30.27 | 4.22 |
| 7 | 30.14 | 4.35 |
| 6 | 30.01 | 4.48 |
| 5 | 29.88 | 4.61 |
| 4 | 29.76 | 4.73 |
| 3 | 29.64 | 4.85 |
| 2 | 29.52 | 4.97 |
| 1 | 29.4 | 5.09 |
| 0 | 29.29 | 5.2 |
| -1 | 29.18 | 5.31 |
| -2 | 29.07 | 5.42 |
| -3 | 28.96 | 5.53 |
| -4 | 28.86 | 5.63 |
| -5 | 28.76 | 5.73 |
| -6 | 28.66 | 5.83 |

**[0027]** The catch plate 20 shown in Figures 6 to 8 is shown in greater detail in Figure 10 and 11. The overall shape of the plate includes an upper bulbous portion which is mounted on the push rod, and a lower tail. The catch plate 20 defines a bore through which the push rod is designed to pass. The tail has an indented portion 36 for accommodating the shoulder of the lever 25 shown in Figures 7 and 8. The catch plate 20 has a rear surface that can be regarded as being in three different parts. The first part 33 lies along a plane that is substantially orthogonal to an axis 36 passing through the centre of the bore 32. The second part 34 is an intermediate curved or flat portion which allows a smooth transition between the first and the tail. The third part 35 is the tail and is substantially planar and inclined from the first part at an angle $\alpha$. This can be any appropriate acute angle.

**[0028]** The foregoing description of the invention is merely illustrative thereof. In an alternative embodiment of the invention, the mechanical advantage is modified by adapting the surface of the stud on the trigger instead or as well. It will be apparent to the person of ordinary skill, and from the foregoing description, as to how this might be done and the above applies to this alternative embodiment mutatis mutandis. It should therefore be appreciated that various variations and modifications can be made without departing from the spirit or scope of the invention as set forth in the accompanying claims.

## Claims

1. A push rod actuator mechanism, comprising a push rod, engagement means for releasably engaging the push rod and trigger means pivotable between first and second positions, the trigger means having a first surface that engages a second surface on the engagement means when the trigger is pivoted to advance the push rod, the first surface following an arcuate path such that the first surface moves across the second surface, at least one of the first surface and the second surface being adapted to adjust the mechanical advantage of the mechanism as the trigger is pivoted between the first and second positions.

2. A mechanism as claimed in claim 1 wherein the second surface is adapted to provide a substantially uniform mechanical advantage.

3. A mechanism according to claim 1 or 2 wherein at least part of the second surface has a sloped profile that extends in the opposite direction to the direction in which said push rod is advanced.

4. A device according to claim 1 or 2 wherein at least part of the second surface has a curved profile that extends in the opposite direction to the direction in which the push rod is advanced.

5. A device according to claim 4 wherein said curve is a convex curve.

6. A device according to any preceding claim comprising a brake for releasably holding the push rod in position when the engagement means are released from engagement with the push rod.

7. A device according to any preceding claim comprising release means actuatable to release the engagement means from engagement with the push rod.

8. A mechanism according to claim 7 in which the release means are actuated by the release of the brake.

9. A dispenser gun including a mechanism as claimed in any preceding claim.

10. A clamp including a mechanism as claimed in any of claims 1 to 8.

11. An engagement means suitable for use in a mechanism according to any preceding claim.

12. A method of modifying a device having a push rod and an engagement means, comprising replacing the engagement means with an engagement means according to claim 11.

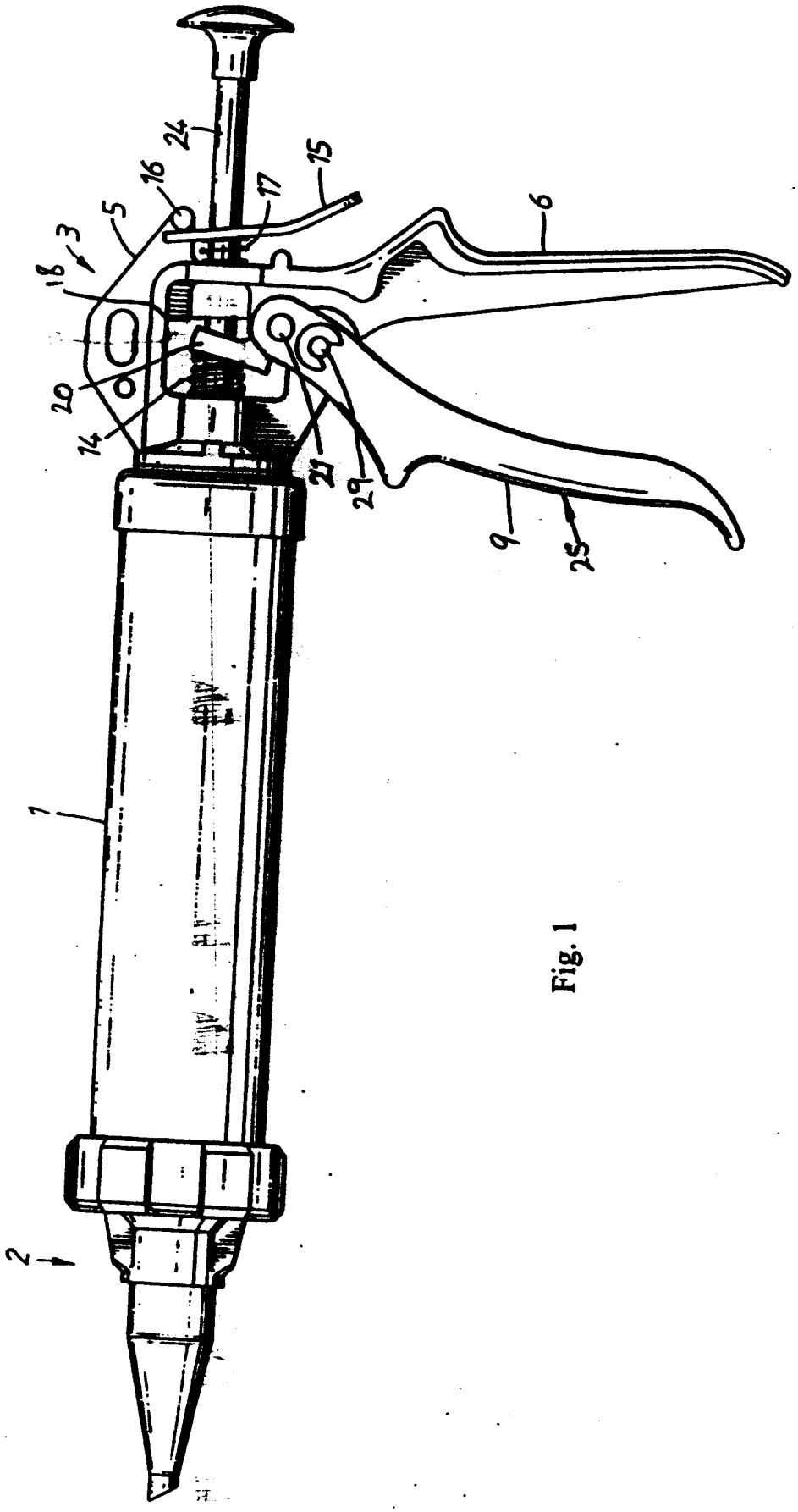



Fig. 1

Fig. 2

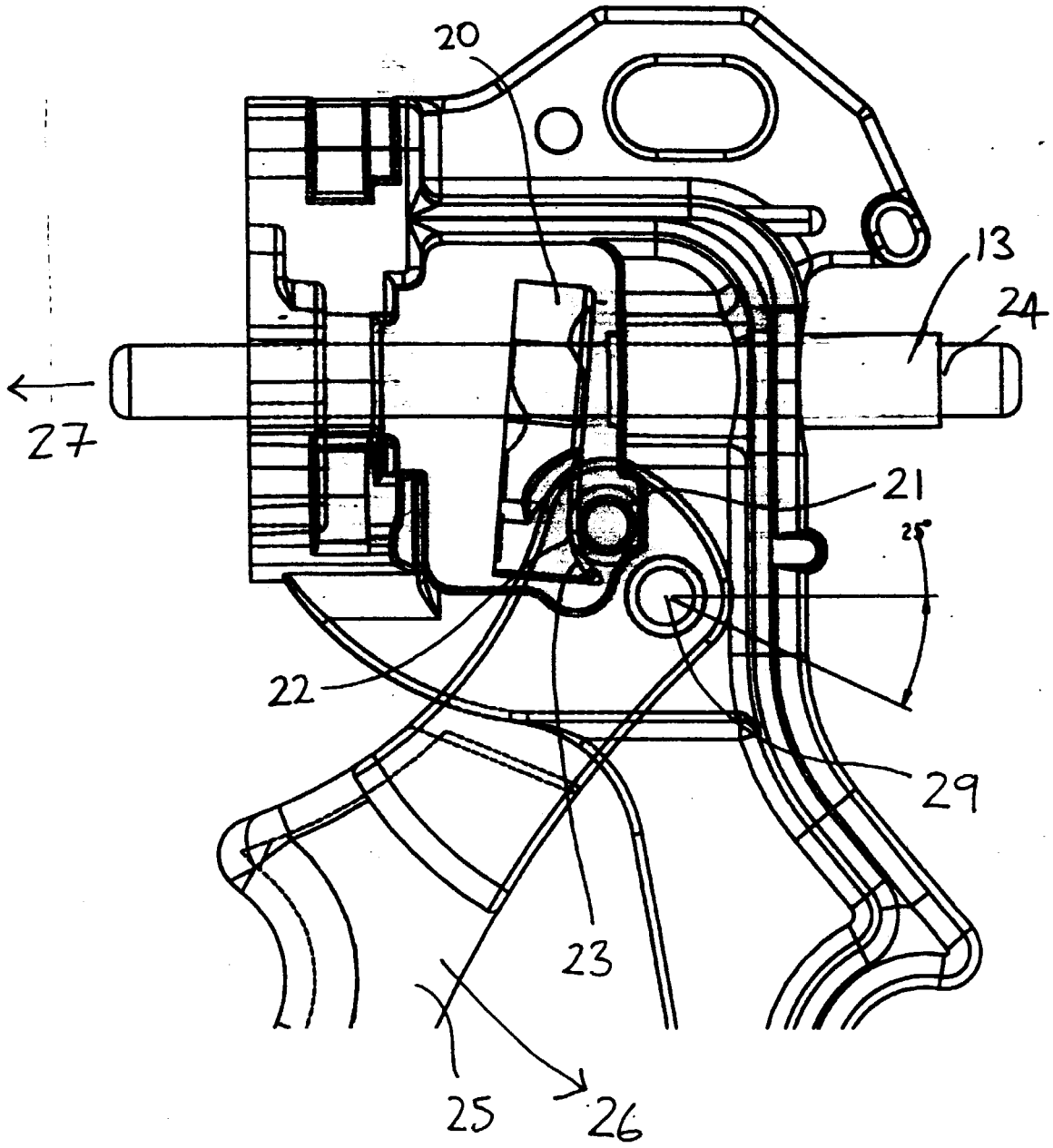


Fig. 3

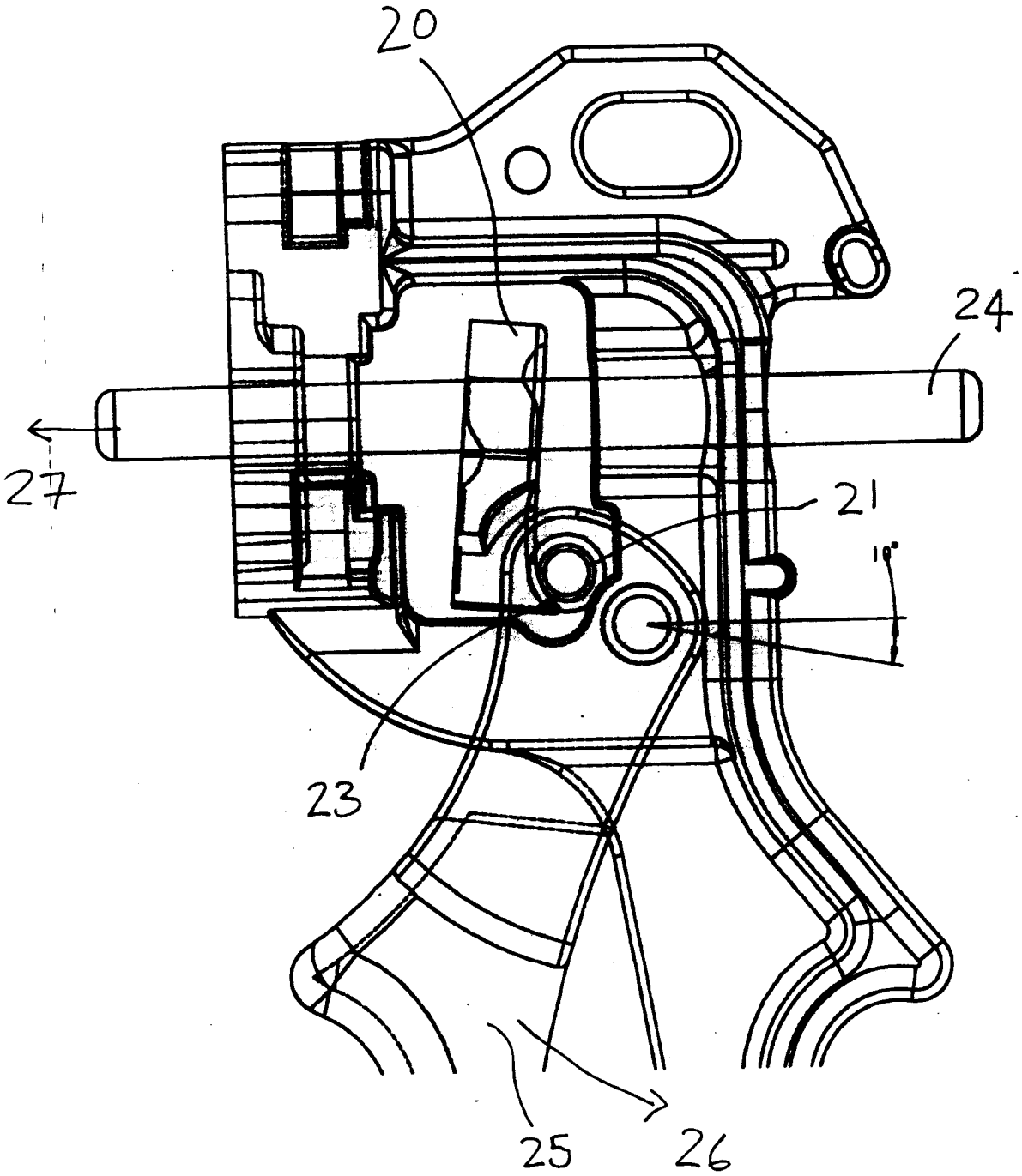


Fig. 4

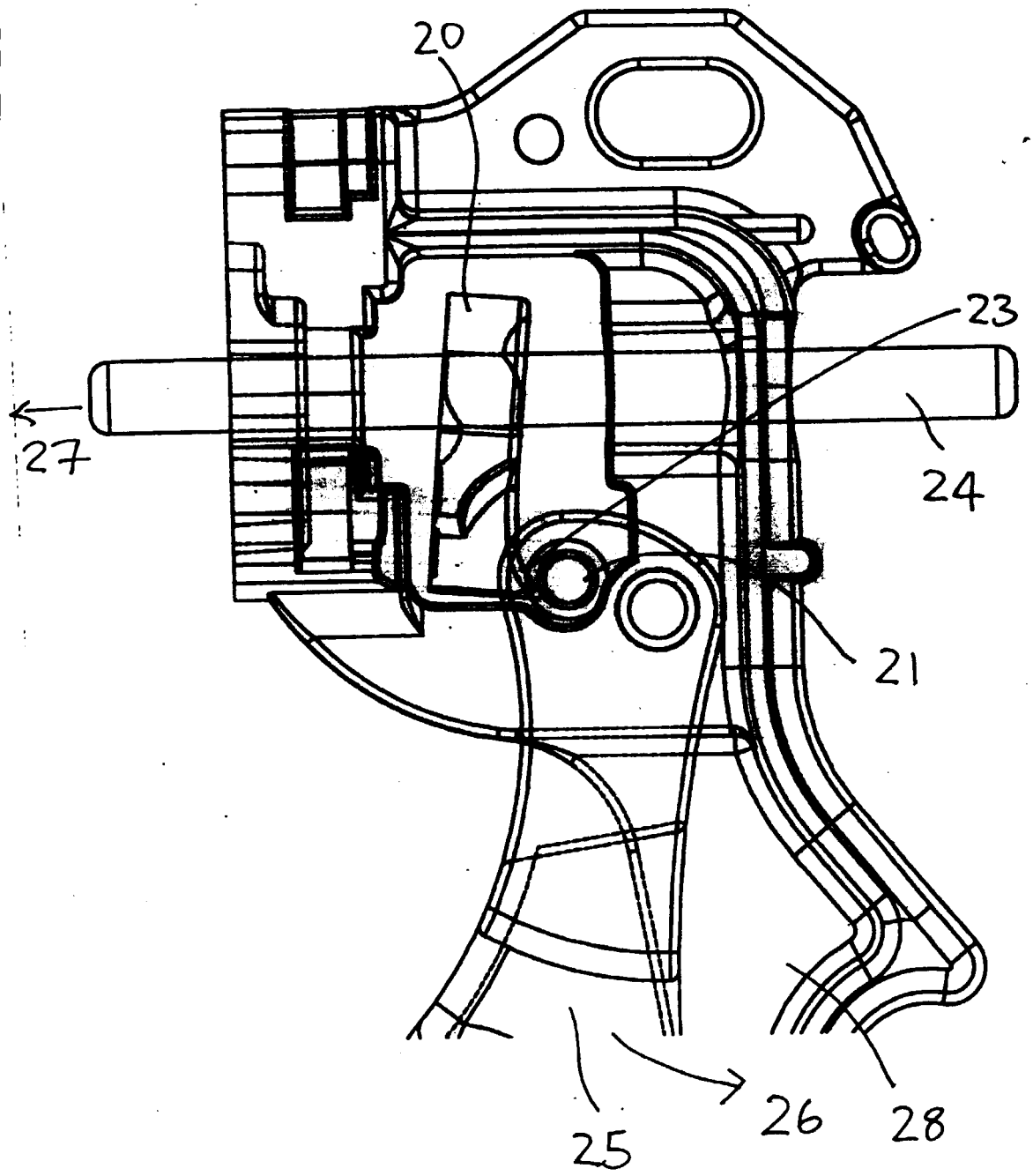


FIG. 5

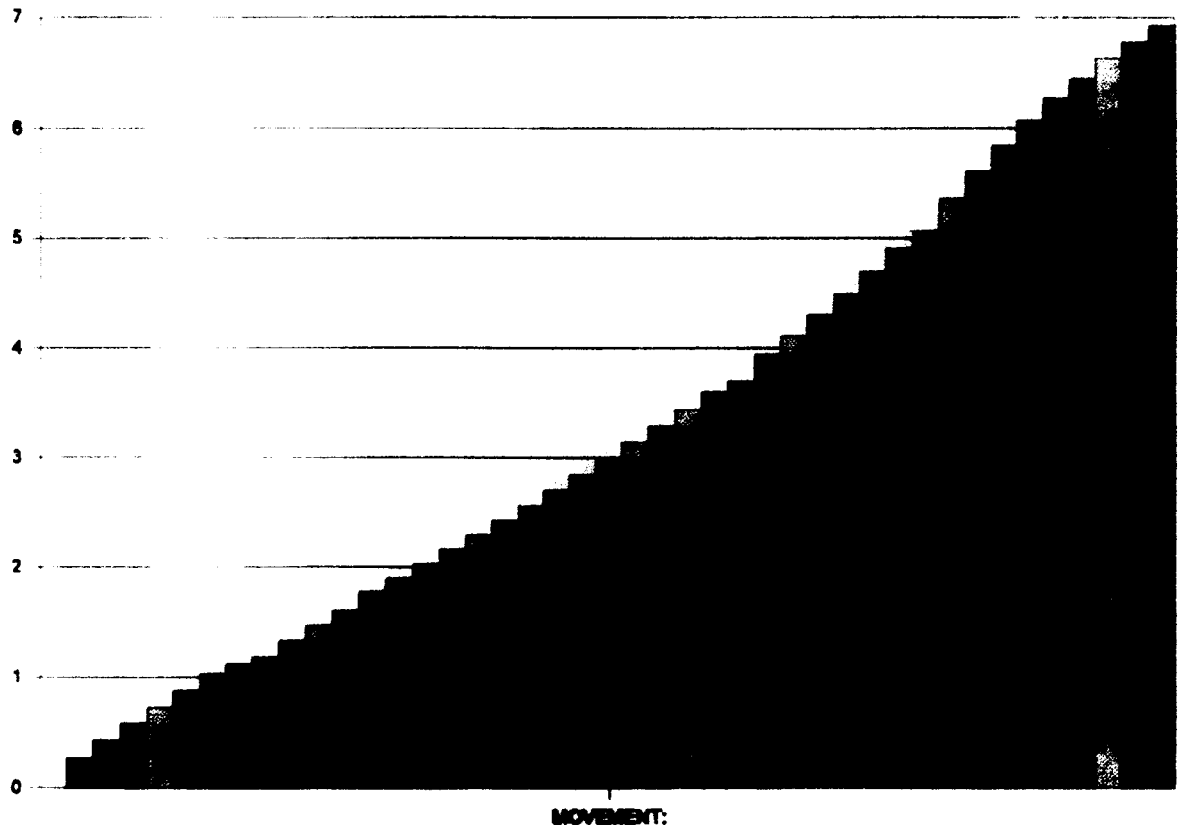


Fig. 6

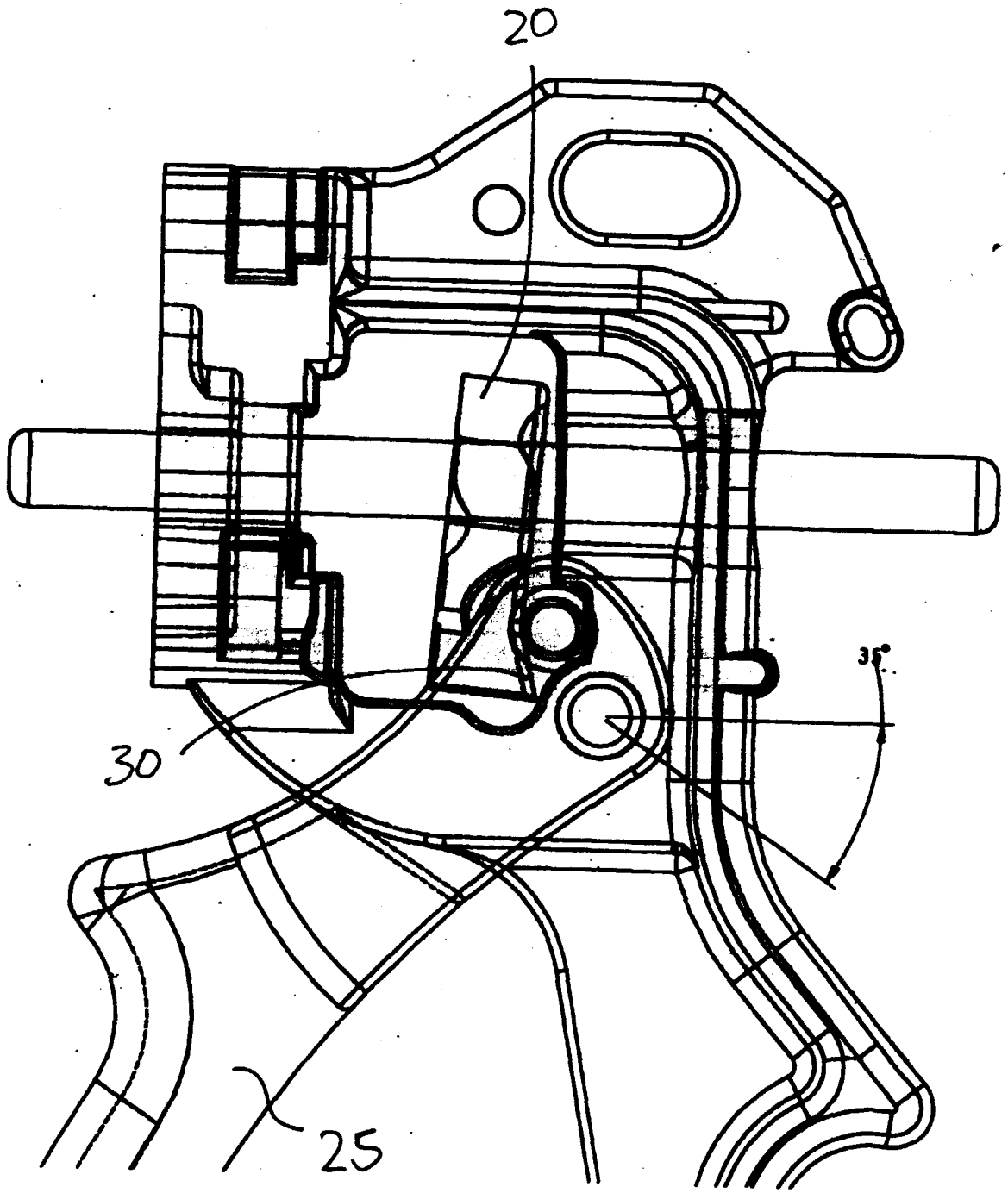


Fig. 7

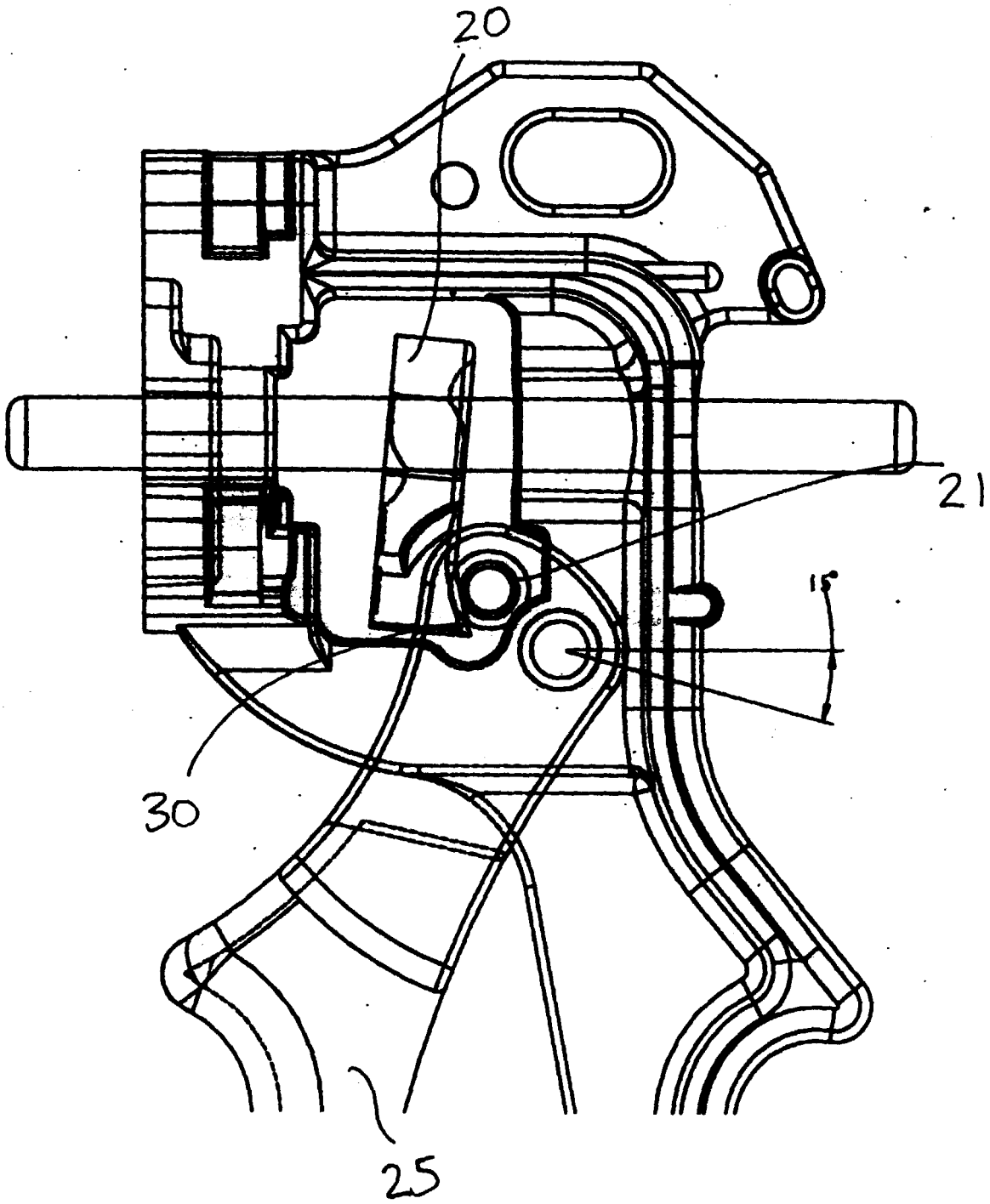


Fig. 8

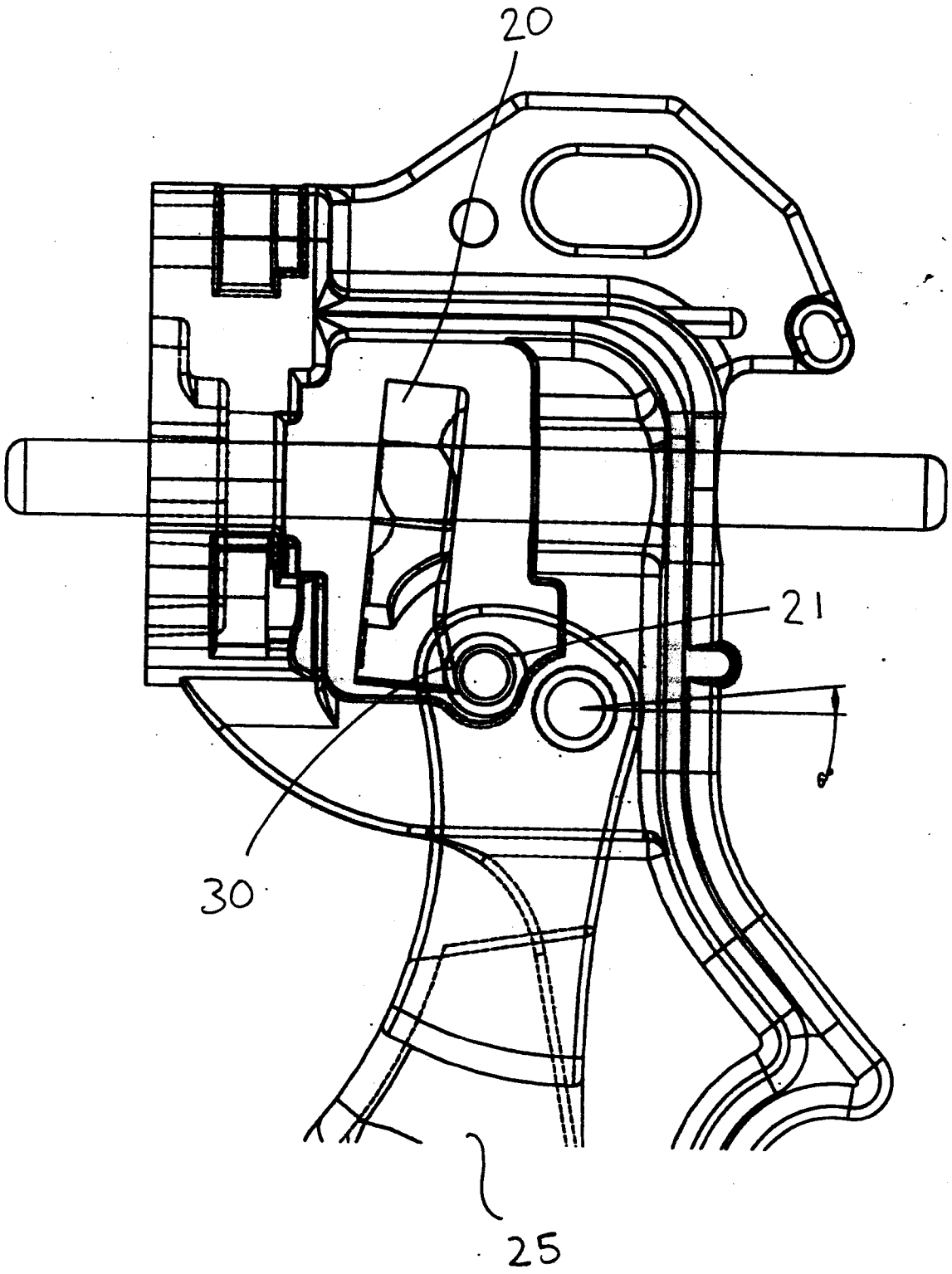


FIG. 9

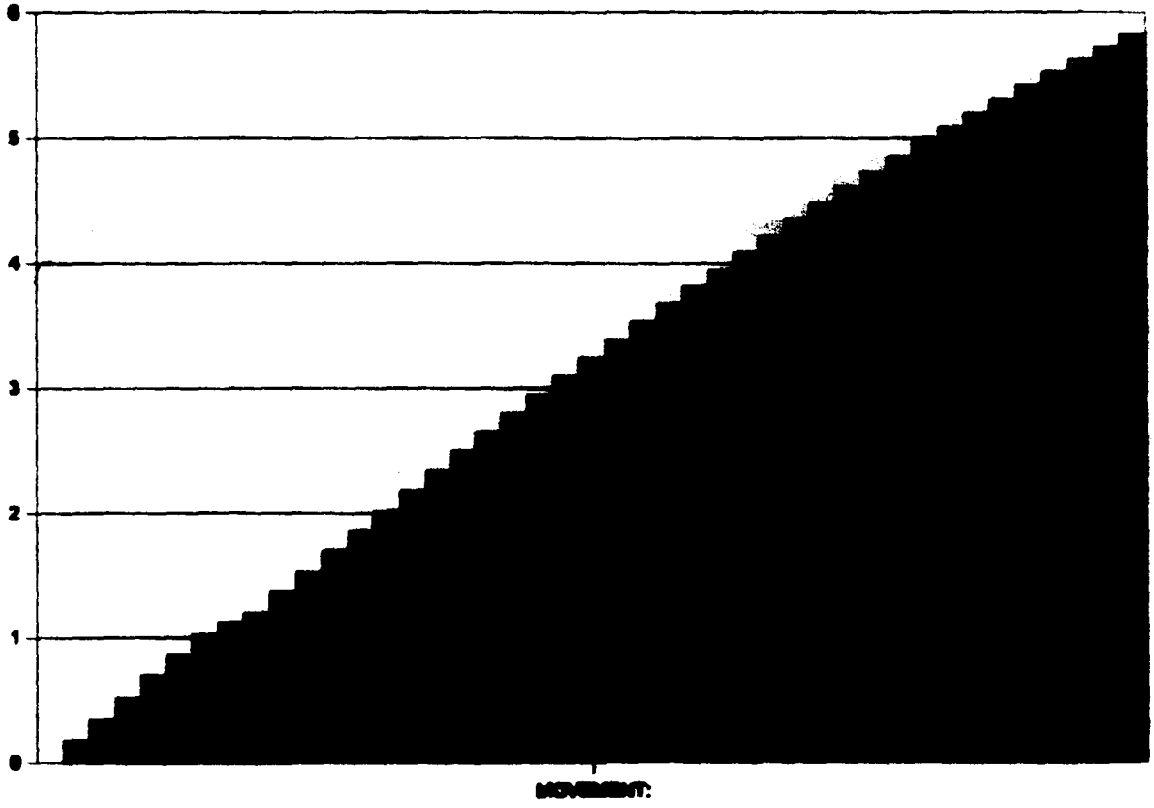
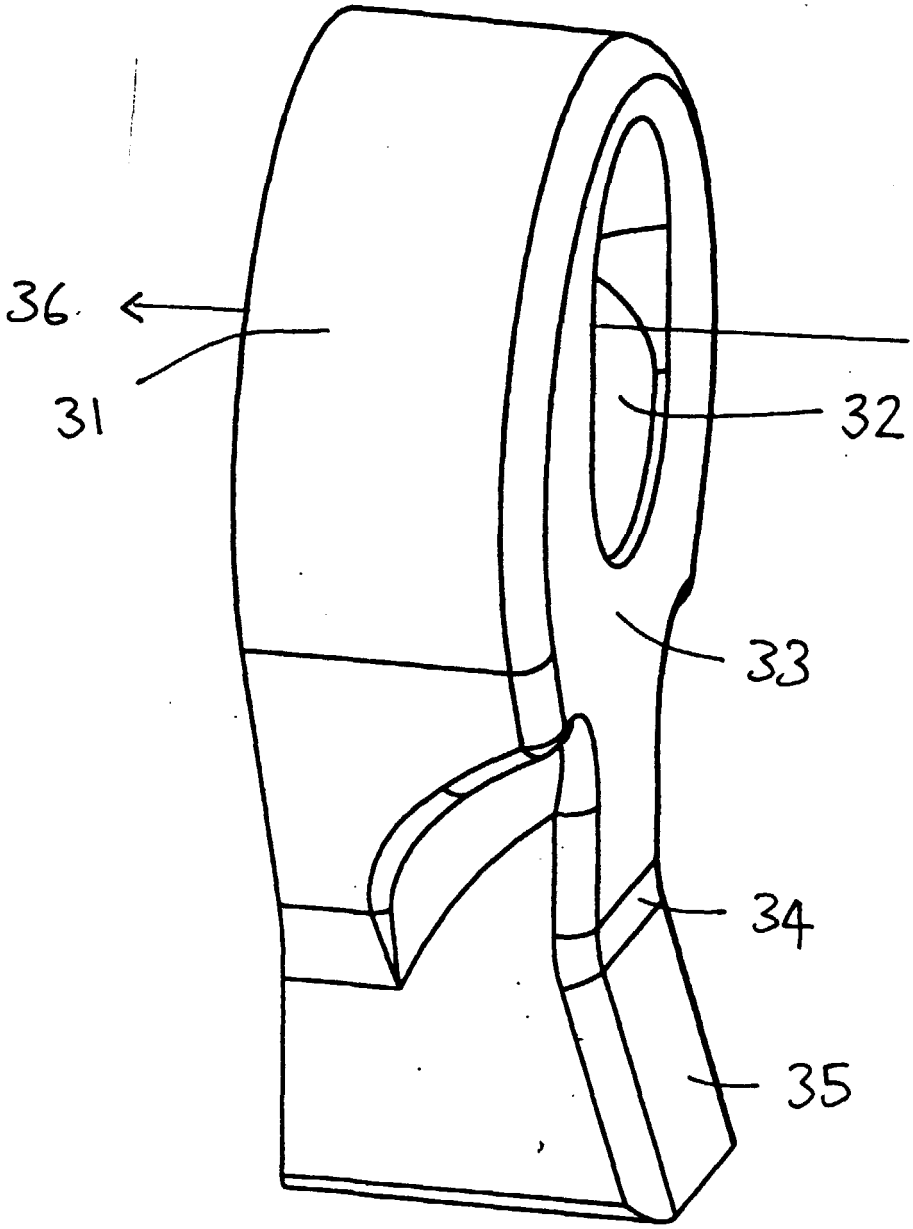


Fig. 10



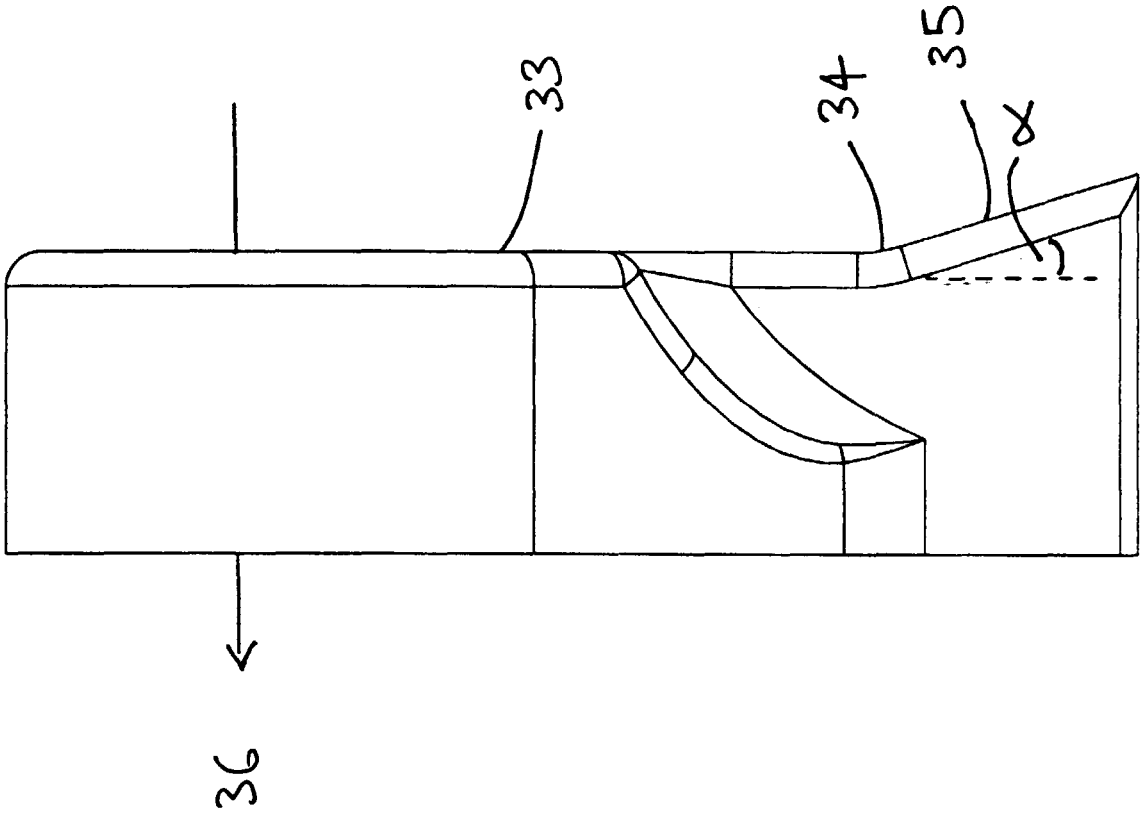



FIG. 11