(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
19 June 2014 (19.06.2014)

WIPO | PCT

(10) International Publication Number
WO 2014/092584 A1

(51) International Patent Classification:
E02F 3/36 (2006.01)

(21) International Application Number:
PCT/NZ2013/000219

(22) International Filing Date:
4 December 2013 (04.12.2013)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
604110 10 December 2012 (10.12.2012) NZ

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

(54) **Title**: A LOCKING MECHANISM

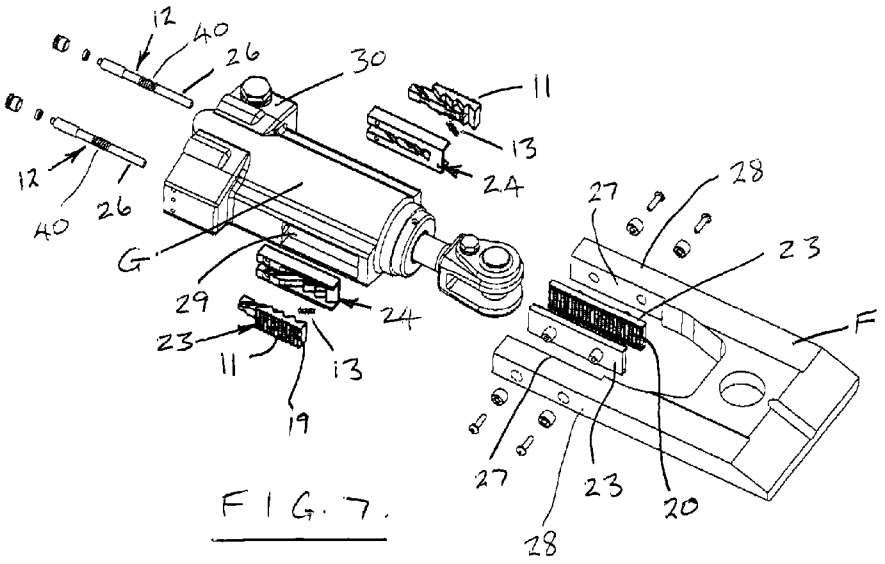

FIG. 7.

(57) **Abstract**: A locking mechanism 10 for a quick coupler A has a movable locking element 11. A biasing element 13 is adapted to bias the locking element 11 to move in a first direction. An operator 12 is arranged to move the locking element 11 against the bias of the biasing element 13. The locking element 11 has teeth or serrations 19 which, when the locking element 11 is moved by the biasing element 13 in the first direction, is engageable with further teeth or serrations 20 coupled to a movable wedge element F of the quick coupler A to lock the wedge element 11 against movement. The movement of the locking element 11 creates a compressive force that causes the teeth / serrations 19, 20 to positively mesh and remain meshed.

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Title of the Invention

A Locking Mechanism

Background to the Invention

This invention relates to a locking mechanism for a quick coupler.

Quick couplers for mounting an attachment, e.g. a bucket, to an earth working machine such as an excavator are known. It is also known to hydraulically operate the quick coupler. A potential danger with an hydraulically operable quick coupler is that in the event of hydraulic failure the quick coupler can fail to retain the attachment in a working position. For example, the coupler can fail to hold the attachment at one of the mounting points with the result that the attachment can swing down from the coupler. The consequences of this can be injury to or death of someone in the vicinity of the attachment when the coupler fails.

Summary of the Invention

An object of the present invention is thus to provide a locking mechanism for a quick coupler whereby an attachment mounted by the quick coupler is retained in a working position on the coupler in the event of hydraulic failure or to at least provide the public with a useful choice.

Broadly according to one aspect of the invention there is provided a locking mechanism for a quick coupler the locking mechanism including a movable locking element, biasing means adapted to bias the locking element to move in a first direction and an operator arranged to move the locking element against the bias of the biasing means, the locking element has engagement means which, when the locking element is moved by the biasing means in the first direction, is engagable with further engagement means coupled to a movable wedge element of a quick coupler to lock the wedge element from moving.

Broadly in a second aspect of the invention there is provided a quick coupler that includes a movable wedge element, hydraulically operable operating means to move the movable element, a movable locking element, biasing means adapted to bias the locking element to move in a first direction and an operator arranged to restrain the locking element against movement in the first direction, the locking element has engagement means which, when the locking element is permitted to be moved by the biasing means in the first direction in the event of failure of hydraulic supply to the operating means, is engagable with the movable element to lock the movable element against movement.

In a preferred form of the invention the biasing means is a mechanical biasing mechanism.

Preferably the mechanical biasing mechanism is at least one spring.

In a preferred form the operator is an hydraulically operated linear actuator.

In a preferred form of the invention the operator is operated by hydraulic pressure that from the hydraulic pressure source of the operating means for the wedge element.

Preferably in one form of the invention the engagement means and further engagement means are both formed by a plurality of teeth that are arranged to intermesh.

Preferably movement of the locking element creates a compressive force that causes the teeth to positively mesh and remain meshed.

In a preferred form of the invention there is provided a stop that is engagable with the locking element when the locking element is restrained by the operator to thereby create a clearance between the engagement means and further engagement means.

In one form the further engagement means are part of a catch component that is adapted to couple to the movable element.

In one form the locking element is movably coupled to a drive component.

In one form the locking element and drive component have inter-engaging drive faces adapted translate movement of the locking element by the biasing means into a lateral movement of the locking element. Preferably in this form the locking element and drive component further include slidingly engaged rails and guides.

In one form of the coupler there is a plurality of locking mechanisms.

Brief Description of the Drawings

In the following more detailed description of one embodiment of the invention and its application to a quick coupler reference will be made to the drawings which form part of this specification and in which:-

Fig. 1 is a diagrammatic side elevation view in section of an hydraulic quick coupler incorporating a first embodiment of a locking mechanism in accordance with the present invention,

Fig. 2 is an enlarged partial view of the arrangement shown in Fig. 1 and illustrates the locking mechanism of Fig.1 when the wedge element of the quick coupler is moved to a wedging position,

Fig. 3 is a detail view of the juxtaposition of the teeth as shown in Fig. 2,

Fig. 4 is a view similar to Fig. 2 when the quick coupler wedge element is moved (retracted) to a non wedging position during normal hydraulic operation of the quick coupler,

Fig.5 is a view similar to Fig. 4 but showing the locking mechanism locking the wedge element upon an hydraulic failure occurring,

Fig. 6 is an isometric view of a coupler with a side removed to show the wedge and cylinder which incorporates a second embodiment of the locking mechanism,

Fig. 7 is an exploded isometric view of the wedge, cylinder with second embodiment of the locking mechanism as shown in Fig. 6,

Fig. 8 is an assembled view of the arrangement shown in Fig. 7 with the wedge fully retracted,

Fig. 9 is a similar view to Fig. 8 but with the wedge fully extended,

Fig.10 is a sectioned isometric partial view showing the locking mechanism components with the teeth fully apart (unlatched state), the section having been taken a quarter way down the mechanism,

Fig. 11 is a view similar to Fig. 10 but with the teeth in a position where any backward movement of the catch 23 will result in inter-engagement of the teeth 19 and 20 to cause the locking mechanism to become engaged so that the latch 11 is no longer able to move forward again into the unlatched state unless the catch 23 also moves forward again,

Fig. 12 is a view similar to Fig. 11 but showing the latch 11 having moved backwards by the bias spring 13 and outwards by the angled faces 25 of the drive component 24 thereby having been moved into a latched state where the two sets of teeth 19 and 20 come into contact with one another,

Fig.13 is a view similar to Fig. 12 showing the teeth 19 and 20 fully engaged in the locked state,

Fig. 14 is an isometric sectioned view of components of the locking mechanism as shown in Figs. 10 to 13 but with the section having been taken at the level of the upper surface of the biasing spring 13,

Fig. 15 is a view similar to Fig. 14 but with the section taken below the biasing spring 13,

Fig. 16 is a view similar to Fig. 15 but with the latch 11shown biased forward into the locked state,

Fig. 17 is an isometric view of the latch 11 and drive component 20 showing the latch in the unlatched state,

Fig. 18 is a view similar to Fig. 17 but with the latch 11 in the engaged (locked) state,

Fig. 19 is a further sectioned view (taken at the level of Fig. 14) which shows the latch 11 moved forward by the biasing spring 13 into the engaged (locked) state and showing a clearance between a release actuator 26 of operator 12 and the latch 11,

Fig. 20 is a view similar to Fig. 19 but with the release actuator 26 having been moved into contact with the latch 11,

Fig. 21 is a view similar to Fig. 20 but with the release actuator 26 having moved the latch 11 backwards against the bias of the spring 13, and

Fig. 22 is a further view similar to Fig. 21 but with the release actuator fully extended so as to have moved the latch 11 fully backwards into the unlatched state.

Description of Preferred Embodiments of the Invention

According to the invention the locking mechanism engages and locks the wedge tongue against movement immediately if there is a failure of hydraulic pressure to the quick coupler so that the wedge tongue is prevented from any movement that may result in release of the mounting point(s) of an attachment mounted by the quick coupler.

Referring firstly to Fig. 1 there is shown a known form of quick coupler A made by our company and a first embodiment of the locking mechanism 10 of the present invention when incorporated in the quick coupler. The quick coupler A is operated hydraulically by the hydraulics of the machine to which the coupler is attached. The body B of the

coupler has mounting points C whereby the coupler is attached to say the arm of an excavator (not shown).

The body B has a hook shaped part D into which one of the mounting pins of an attachment (not shown) engages. Another mounting pin of the attachment locates in the recess E. An hydraulically powered wedge element or tongue F (hereinafter "wedge F") is extendible to capture the attachment mounting pin in the recess E whereby the attachment is coupled to the coupler A in its working position.

Thus if the hydraulic power to the coupler A fails the wedge F can retract which will enable release of the mounting pin from the recess E to occur. If the other pin in hook shaped part D is not retained in position the attachment can fall from the excavator arm. If the pin in the hook shaped part D is, however, retained (by say our I Lock device as described and claimed in our New Zealand patent specification 552294/546893) then the attachment will not fall completely off the coupler A but will swing down on the pin in hook shaped part D.

In the form of coupler A shown in Fig. 1 the wedge F is part of an operating means formed by hydraulic cylinder G which controls the extension and retraction of the wedge F. This is only one example of the form that the cylinder G and wedge F arrangement may take.

In the illustrated form of the coupler A the locking mechanism 10 is integrated into the cylinder G/ wedge F interface, however, this is only one example of how the locking mechanism of the present invention may be incorporated into a quick coupler. A further embodiment will be described later with reference to Figs. 6 to 22.

Referring now to Fig. 2 (and its associated detail drawing in Fig. 3) the locking mechanism 10 includes a locking element 11 (hereinafter "latch 11"), an operator 12 preferably in the form of a linear actuator (e.g. hydraulic cylinder) and a mechanical biasing element 13 preferably in the form of e.g. a spring. The cylinder 12 is arranged to be operable by the machine hydraulics when the wedge F is retracted (see Figure 4). The mechanical biasing mechanism biases the latch 11 into movement in a first direction that is indicated by the letter X.

The latch 11 is substantially wedge shaped. A surface of the latch 11 and a surface fixed in relation to the coupler body B form a sliding interface 14 that will hereinafter be described in more detail. The latch 11 has a fixed surface 16 against which the cylinder can act. Thus in the first preferred embodiment as illustrated in Figs. 1 to 5 a shoulder 15 provides the surface 16 with which the cylinder 12 is engagable.

One end of the spring biasing element 13 is located in a pocket (bore) 17 in the latch 11. The other end of spring 13 engages against a fixed surface 18.

A surface of the latch 11 that forms one side of the interface 14 is provided with teeth or serrations 19 (hereinafter "teeth 19") which are located opposite to, and are inter-engagable with, teeth or serrations 20 (hereinafter "teeth 20") that are coupled to the wedge F of the coupler (see detail in Figure 3). The teeth 20 can be part of an element (as described in the second embodiment) that is attachable to some part of the wedge F or the wedge operating cylinder G. However, the connection of teeth 20 to the wedge F is achieved is not important to the invention the primary criteria being that the teeth 20 move with the wedge F.

The detail drawing forming part of Fig. 3 shows the preferred configuration of the teeth sets 19 and 20. They can however, take different forms provided they achieve the functional parameters as will herein after become apparent.

The teeth sets 19 and 20 are such that when the wedge F is moved (extended) into its operative wedging position the teeth 20 ride over the teeth 19 due to the contact angle. The detail drawing of Fig. 3 shows the teeth sets 19 and 20 when teeth 20 ride over the teeth 19. The latch 11 is free to move against the tension of spring 13 as the wedge F is extended so that the teeth 19 and 20 ride over one another so that the latch 11 does not inhibit the extension of the wedge F.

When the wedge F has moved into its extended position the spring 13 drives the latch 11 in direction X to ensure that the teeth 19 and 20 engage and thus lock the wedge F in its extended position.

Under normal operating conditions the controls for the coupler are operated to cause the wedge F to retract. Consequently hydraulic pressure is applied to the retract side of the double acting cylinder G which simultaneously applies pressure to operator 12. The operator 12 thus extends the release actuator 26 and applies pressure to surface 16 of shoulder 15 which causes latch 11 to move against the pressure of the biasing spring 13 i.e. in the direction indicated by the letter Y.

In the preferred arrangement as illustrated in Fig. 1 to 5 of the drawings the latch 11 comes into contact with a stop which conveniently is formed by surface 18. When the latch 11 is against stop 18 a clearance (indicated by the letter Z) is formed between the teeth 19 and 20. This ensures that the wedge F can freely retract (Figure 3).

However, if at any time there is a failure in hydraulic pressure to the coupler (which will remove pressure to wedge cylinder G) and wedge F is no longer held in its operative (extended) position by double acting cylinder G the bias spring 13 continues to drive the

locking member in direction X along the sliding interface 14 and the resultant compressive load in the direction of arrow 21 will cause teeth 19 and 20 to remain meshed thereby continuing to lock the wedge F in its extended position.

As a result the wedge F is prevented from retracting in the direction of arrow 22 thereby ensuring that despite the hydraulic failure the wedge F retains the attachment pin in the recess E.

The locking mechanism 10 therefore locks the wedge F in its extended position and this locking effect is not lost upon an occurrence of hydraulic supply failure.

Due to the number of teeth over which the load is transferred back to the operator 12 and the compressive loading created due to the slide angle, teeth 19 and 20 may be relatively small which means backlash in the mechanism is very small and effectively creates infinitely variable locking positions. As a result the wedge F will be locked irrespective of what extended position the wedge F takes. Also the teeth 20 mesh across all or substantially all of teeth 19.

With the type of coupler illustrated in Fig. 1 the position of the locking mechanism between the coupler wedge cylinder G and the wedge interface means that it is possible to create retro-fit kits for existing coupler products in the market. These kits can be fitted in the field. The skilled person will therefore appreciate that retro-fit kits can be made for not only the coupler type illustrated and described herein.

Figs. 6 to 22 illustrate a second embodiment of the locking mechanism of the invention. One difference between the first and second embodiments is that in the second embodiment there are preferably (as shown) two locking mechanisms (one either side of the cylinder G and wedge F) rather than the single mechanism below the wedge F.

Components of the second embodiment that correspond with those of the first embodiment are, for convenience, indicated by the same reference numerals.

Fig. 6 shows the coupler A but with one side plate component of the body B removed to reveal the hydraulic cylinder G and wedge F. It also shows the locking mechanism 10 but this is better seen in Fig. 7 and subsequent drawings.

Fig 7 illustrates how the teeth/serrations 20 (hereinafter "teeth 20") are part of a catch plate component ("catch") 23 that is fastened by suitable mechanical fasteners to a rebated inner surface 27 of the leg 28 of a bifurcated section of the wedge F. As shown there is a locking mechanism 10 associated with each leg 28 of the wedge F.

Similarly there is associated with a mounting recess 29 at each side of the cylinder C a drive component 24 and a latch 11. As shown latch 11 has teeth/serrations 19 (i.e. teeth19).

Thus as described above there are two locking mechanisms 10 in the second embodiment but the following description will, for convenience, primarily concentrate on the construction and operation of only one of the locking mechanisms 10.

Fig. 7 also shows how there is a pair of operators 12 with associated actuators 26 mounted in either side of housing 30 so that each operator 12 can work on a respective latch 11 of the two locking mechanisms 10.

Figs. 10 to 13 are sectioned views with the section level being substantially a quarter way down the cylinder G. Fig. 10 shows the locking mechanism components 11, 23 and 24 with the teeth 19 and 20 fully apart (unlatched state). The clearance Z mentioned in the first embodiment is also shown. A large serrated part of the latch 11 meshes with the corresponding serrated part of the drive component 24 to form a series of drive faces 31 and 32 and stop faces 33 and 34 with a end stop face 18 (see Figs. 11 and 12) being formed by an end wall of the mounting recess 29.

As is apparent from Figs. 14 and 19 to 22 the bias spring 13 is located in pocket 17 in the latch 11 and this acts against stop face 34'.

The controlled longitudinal and lateral movement of latch 11 by the drive component 24 is further enhanced by the drive component 24 having angled guide rails 35 and 36 that engage with guide slots 37 and 38 in the latch 11 (see for example Figs. 14 to 16). These rails 35 and 36 align with the latch plate slots 37 and 38 and assist the release process when the release actuator 26 pushes on the back face 39 of the latch 11. The slot face slides on the rail thereby pulling the latch 11 back in a controlled line with the drive faces 31 and 32 and bias spring 13. These also assist with a ratchet effect that occurs when the wedge F is extended, thereby ensuring that the movement of latch 11 is parallel and consistent between each of the sets of teeth 19 and 20.

Figs. 17 and 18 show how the latch 11 can move from the "retracted" state (unlatched) of Fig. 17 to the "extended" state (engaged) of Fig. 18 and further shows the portion of latch 11 with slots 37 and their interaction with rails 35.

Figs. 19 to 22 show a section taken at a level that shows the spring 13 in the pocket 17. These drawings also show how the actuator 26 of the operator 12 can engage with surface 39 of latch 11 and drive the latch 11 back into the unlatched state. In the preferred form the release actuator 26 has its own return spring 40 (see Fig. 7) which retracts the actuator 26 away from the latch 11 contact face 39 (Fig. 19) when its

hydraulic pressure is released. This ensures that the bias spring 13 only has to effect the movement of latch 11.

The second embodiment operates in the same manner as the first embodiment. Thus, for example, Fig. 10 shows the latch 11 moved to its fully retracted (unlatched) position where the clearance Z allows the wedge F to be moved without any interference i.e. from teeth 19 and 20 making contact.

Fig. 11 shows the teeth 19 and 20 in a position where any backward movement of the catch 23 will result in inter-engagement of the teeth 19 and 20 to thereby cause the locking mechanism 10 to become engaged so that the latch 11 is no longer able to move forward again into the unlatched state unless the catch 23 also moves forward again.

Fig. 12 shows the latch 11 having moved backwards by the bias spring 13 and outwards by the angled faces 31 of the drive component 24 thereby having been moved into a latched state where the two sets of teeth 19 and 20 come into contact with one another.

Fig. 13 shows the teeth 19 and 20 fully engaged in the locked state. Any movement of the catch 23 backwards causes the latch 11 to drive further back on the drive component 24 which locks the wedge F in place.

There are three main components that make up the locking mechanism, latch 11, drive component 20 and the catch 23, plus spring 13 being a bias mechanism. The drawings show their assembly configuration within the illustrated coupler, but could be varied in other sized couplers. These parts are designed as such to be serviceable parts, but could be integrated within the coupler in which they are assembled.

A technical aspect of the invention is the relationship between angle of movement of the latch 11 on the drive component 24 and the angle of the sets of teeth 19 and 20. The latch 11 in the preferred form moves at an angle of 30 degrees while the teeth 19,20 angle is set at 45 degrees. During operation what happens is that when the front of the teeth 19 and 20 are in contact with each other, they are sitting in the latched state. If after this the catch 23 moves backwards enough to shift into the engaged state (an engaged state being the point where the two sets of teeth 19 and 20 are permanently interlocked) they are no longer able to be separated due to the cross over angle relationships. This leaves the locking mechanism 10 in an engaged state and separation is unable to happen until the catch 23 is moved forwards out of the way. This state is shown by Fig. 11.

The locking mechanism of the present invention is operable in the event of hydraulic failure to ensure an attachment mounted by the quick coupler is retained in a working position on the coupler.

The present invention has been described and illustrated by way of a specific embodiments. It is not the intention of the Applicant to restrict or in any way limit the scope of the invention to such detail. For example, the coupler illustrated herein is only one type of coupler with which the locking mechanism can be used. Also the locking mechanism can be provided in retro fit kits to be fitted to couplers other that the type illustrated in the drawings and described herein.

Another example of how the invention can be realised in a different embodiment is that the release actuator does not need to be hydraulically operated. The skilled person will for example readily understand that the invention is relevant to a hose-less hydraulic-less coupler and in such an arrangement, as well as a coupler of the type described herein, other means for releasing can be employed.

Additional advantages and modifications will be readily apparent to those skilled in the art. Therefore, the invention in its broader aspects is not limited to the specific details, representative means of manufacture and method, and illustrative examples shown and described. Accordingly, departures may be made from such details without departure from the spirit or scope of the Applicant's general inventive concept.

CLAIMS:-

1. A locking mechanism for a quick coupler the locking mechanism including a movable locking element, biasing means adapted to bias the locking element to move in a first direction and an operator arranged to move the locking element against the bias of the biasing means, the locking element has engagement means which, when the locking element is moved by the biasing means in the first direction, is engagable with further engagement means coupled to a movable wedge element of a quick coupler to lock the wedge element from moving.

2. A locking mechanism as claimed in claim 1 wherein the biasing means is a mechanical biasing mechanism.

3. A locking mechanism as claimed in claim 2 wherein the mechanical biasing mechanism is at least one spring.

4. A locking mechanism as claimed in claim 1, 2 or 3 wherein the operator is an hydraulically operated linear actuator.

5. A locking mechanism as claimed in claim 4 wherein the operator is operated by hydraulic pressure from the hydraulic pressure source of the operating means for the wedge element.

6. A locking mechanism as claimed in any one of the preceding claims wherein the engagement means and further engagement means are both formed by a plurality of teeth that are arranged to intermesh.

7. A locking mechanism as claimed in claim 6 wherein movement of the locking element creates a compressive force that causes the teeth to positively mesh and remain meshed.

8. A locking mechanism as claimed in any one of the preceding claims further including a stop that is engagable with the locking element when the locking element is restrained by the operator to thereby create a clearance between the engagement means and further engagement means.

9. A locking mechanism as claimed in any one of the preceding claims wherein the further engagement means are part of a catch component that is adapted to couple to the movable element.

10. A locking mechanism as claimed in any one of claims 1 to 9 wherein the locking element is movably coupled to a drive component.

11. A locking mechanism as claimed in claim 10 wherein the locking element and drive component have inter-engaging drive faces adapted translate movement of the locking element by the biasing means into a lateral movement of the locking element.

12. A locking mechanism as claimed in claim 11 wherein the locking element and drive component further include slidingly engaged rails and guides.

13. A quick coupler that includes a movable wedge element, operating means to move the movable element, a movable locking element, biasing means adapted to bias the locking element to move in a first direction and an operator arranged to restrain the locking element against movement in the first direction, the locking element has engagement means which, when the locking element is permitted to be moved by the biasing means in the first direction in the event of failure of hydraulic supply to the operating means, is engagable with the movable element to lock the movable element against movement.

14. A quick coupler as claimed in claim 13 wherein the biasing means is a mechanical biasing mechanism.

15. A quick coupler as claimed in claim 13 or 14 wherein the engagement means and further engagement means are both formed by a plurality of teeth that are arranged to intermesh, wherein movement of the locking element creates a compressive force that causes the teeth to positively mesh and remain meshed.

16. A quick coupler as claimed in any one of claims 13 to 15 further including a stop that is engagable with the locking element when the locking element is restrained by the operator to thereby create a clearance between the engagement means and further engagement means.

17. A quick coupler as claimed in any one of claims 13 to 16 wherein the further engagement means are part of a catch component that is adapted to couple to the movable element.

18. A quick coupler as claimed in any one of claims 13 to 17 wherein the locking element is movably coupled to a drive component.

19. A quick coupler as claimed in any one of claims 13 to 18 wherein the operator is an hydraulically operated linear actuator that is operated by hydraulic pressure from the hydraulic pressure source of the operating means for the movable element.

20. A quick coupler as claimed in any one of claims 13 to 19 wherein there is a plurality of locking mechanisms.

21. A locking mechanism substantially as herein described with reference Figs. 1 to 5 or 6 to 22 of to the accompanying drawings.

22. A quick coupler substantially as herein described with reference to Figs. 1 to 5 or 6 to 22 of the accompanying drawings.

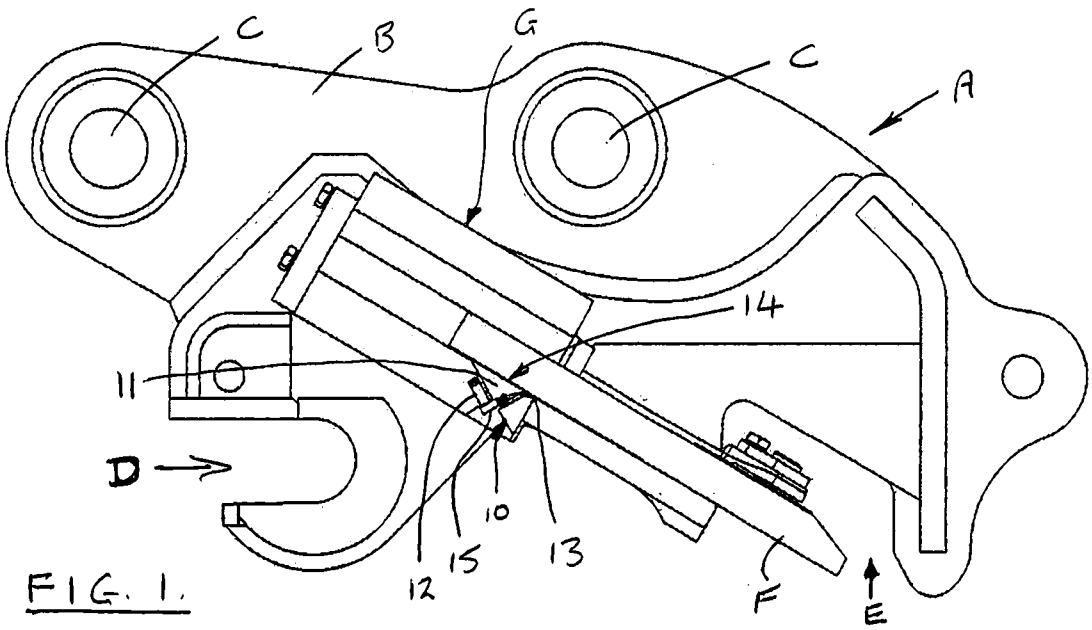

FIG. 1.

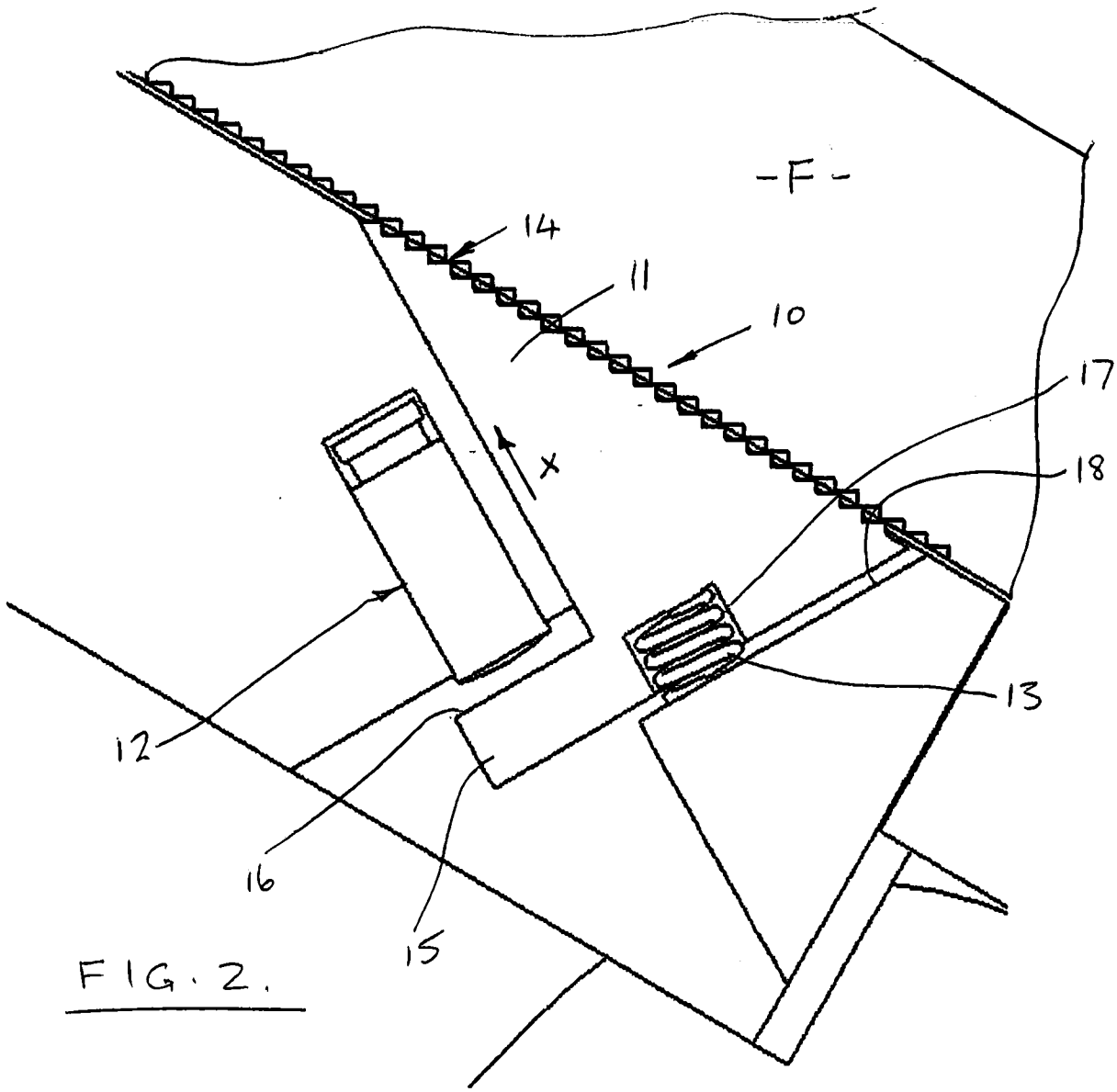

FIG. 2.

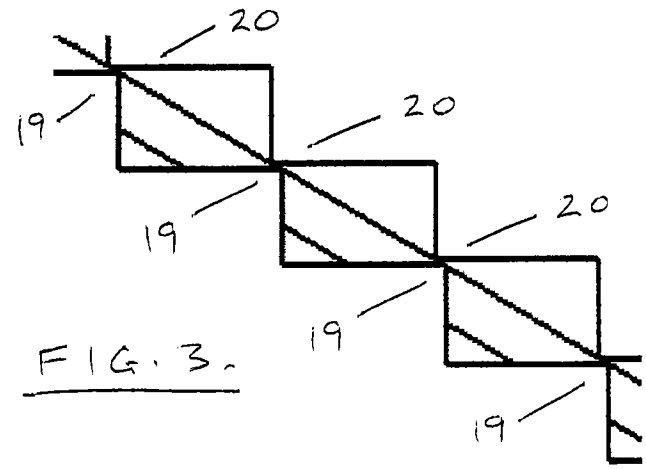

FIG. 3.

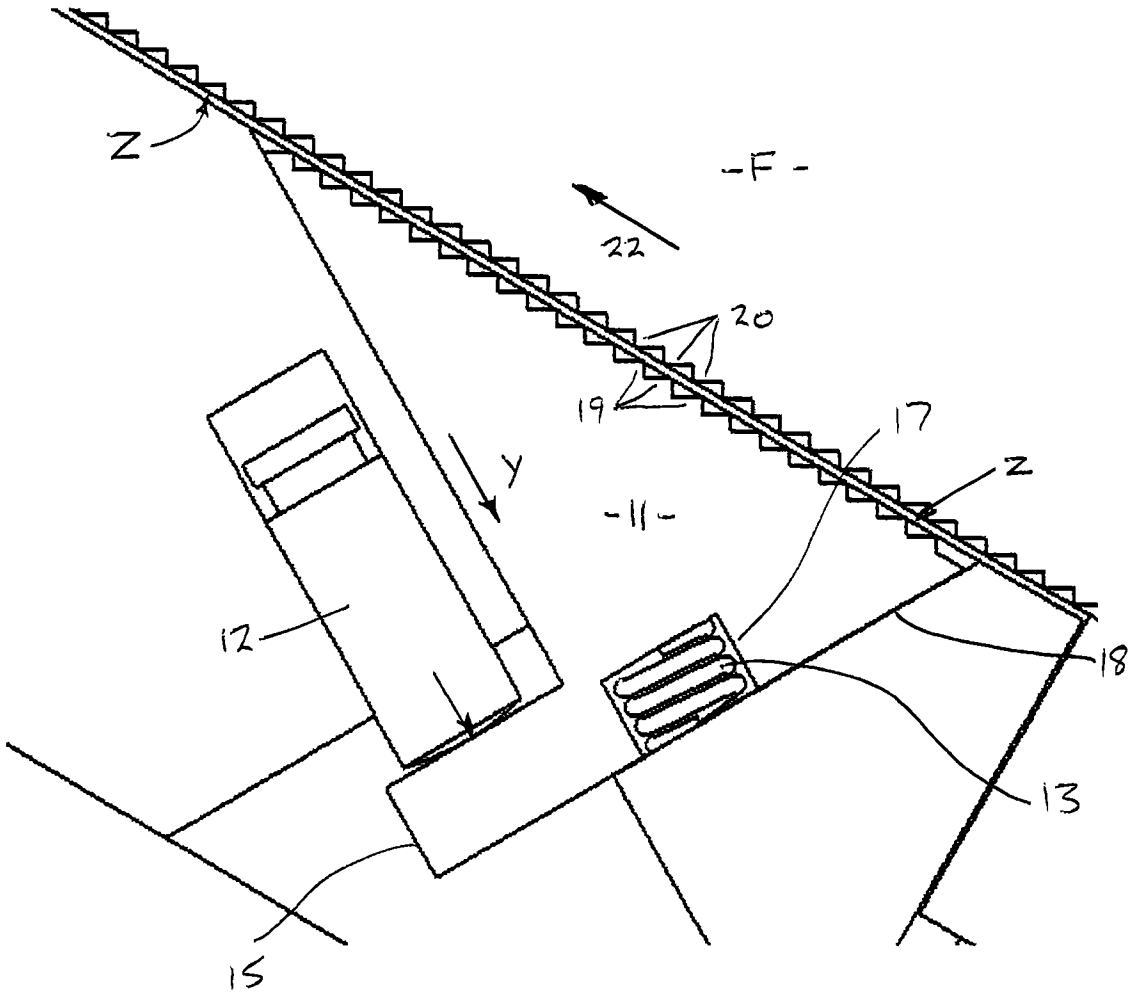

FIG. 4.

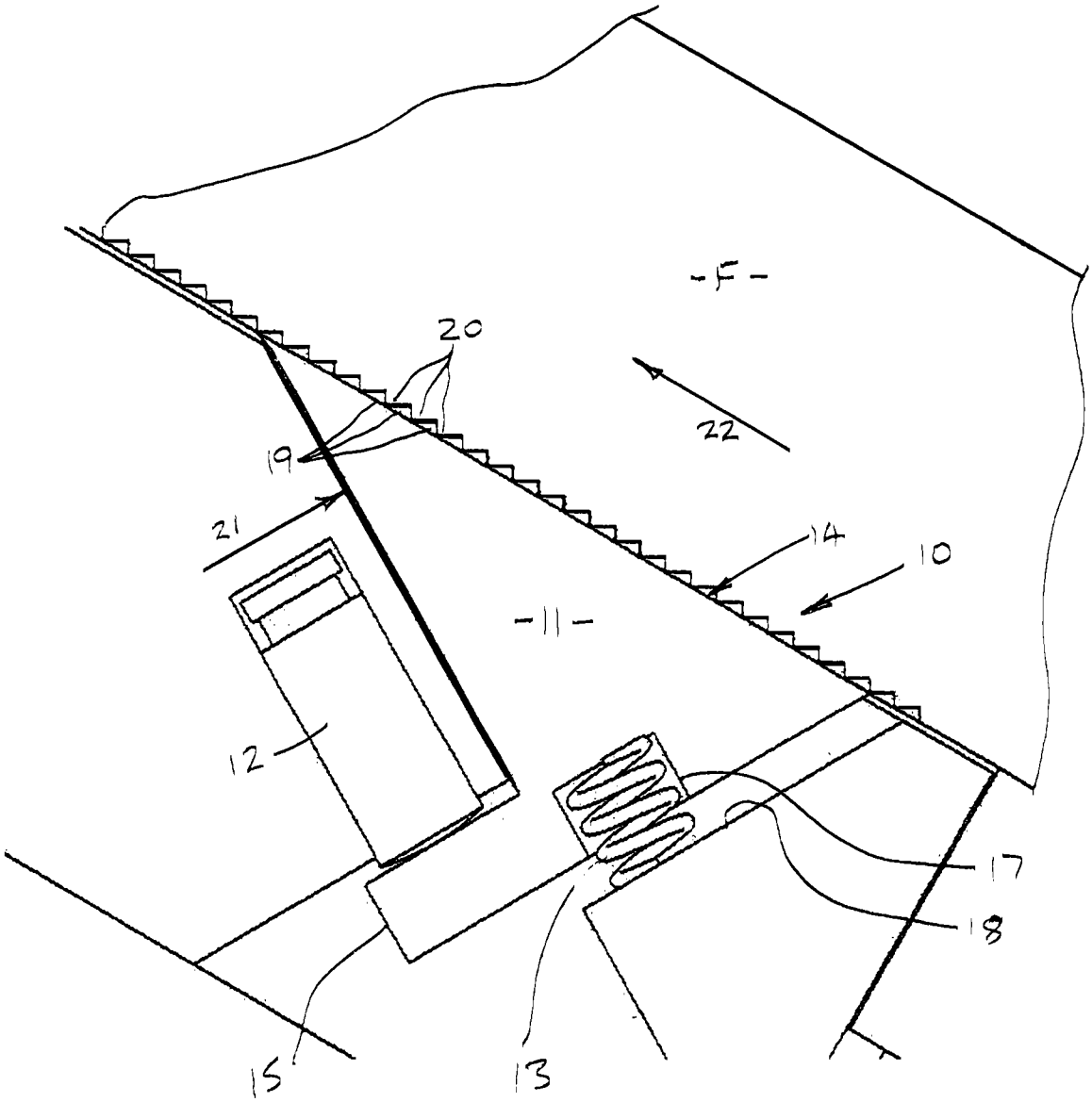

FIG. 5.

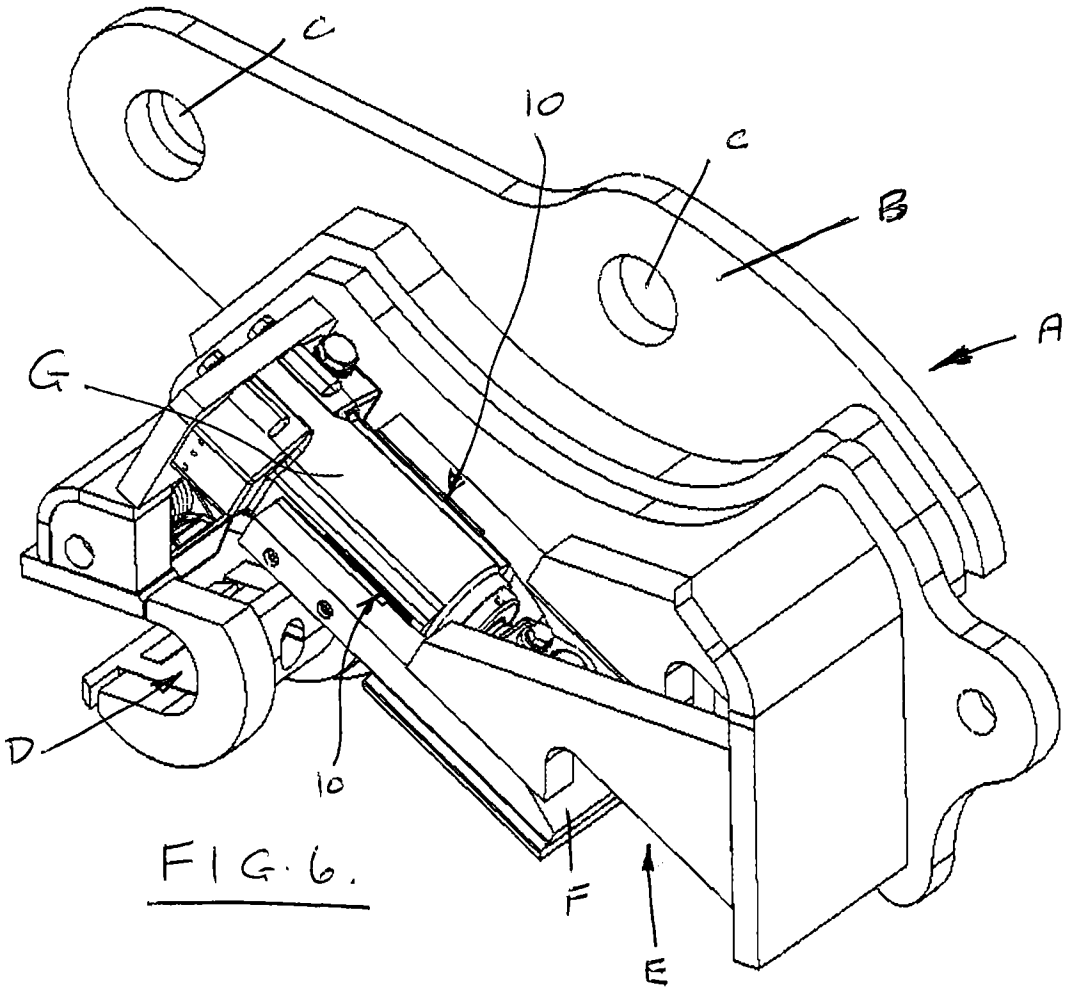
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FIG. 6.

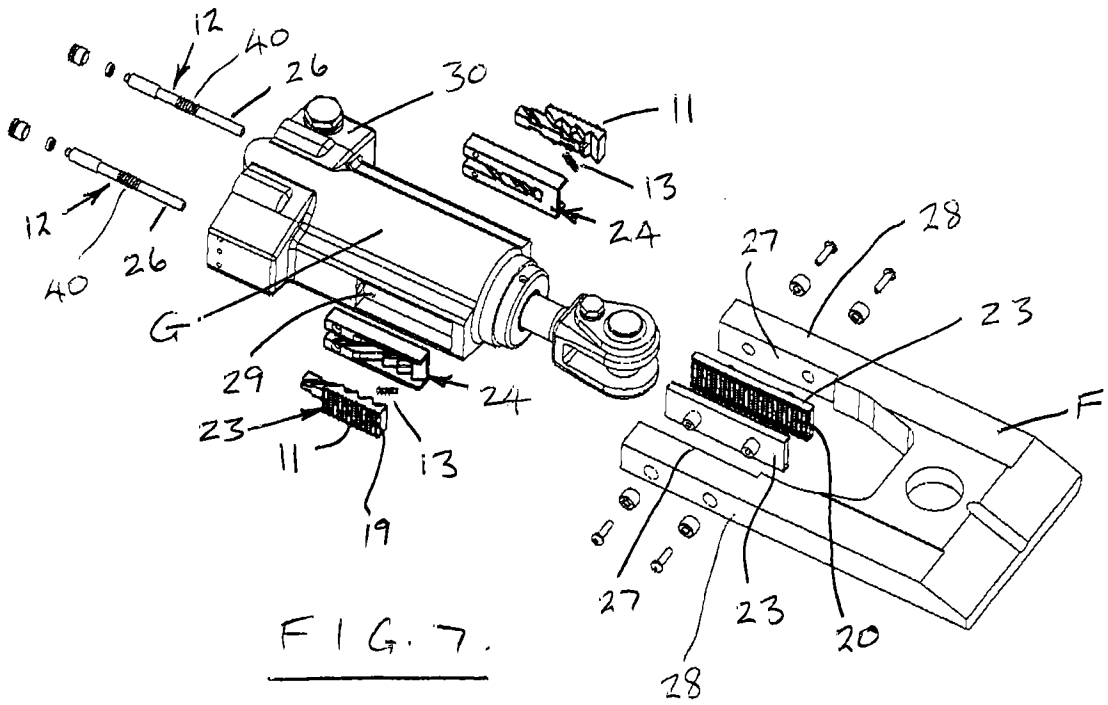
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FIG. 7.

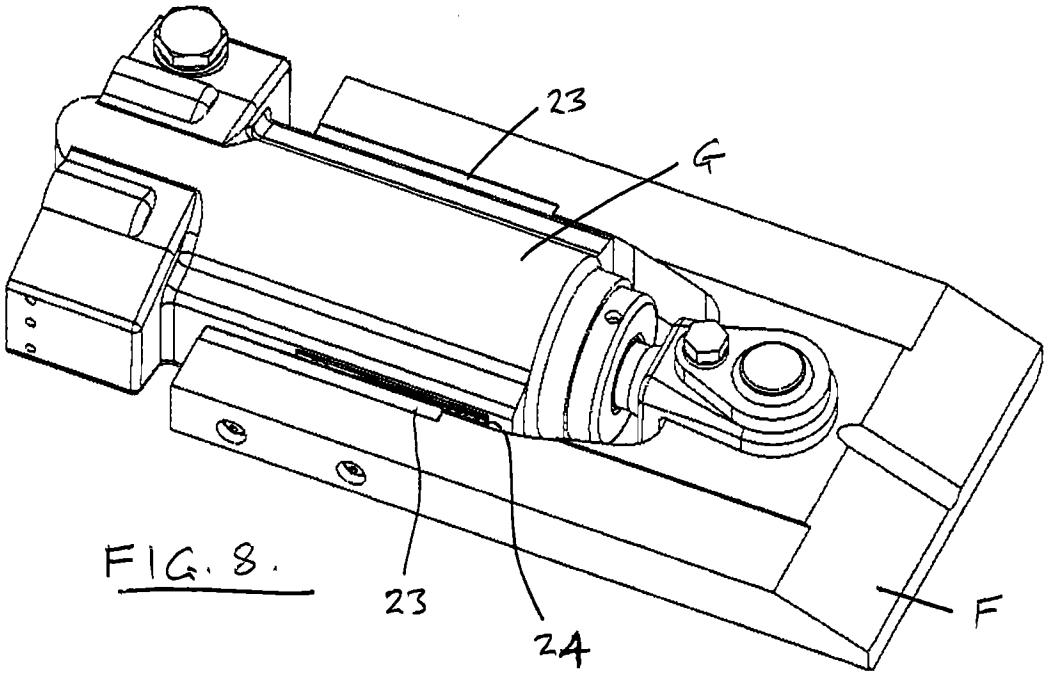


FIG. 8.

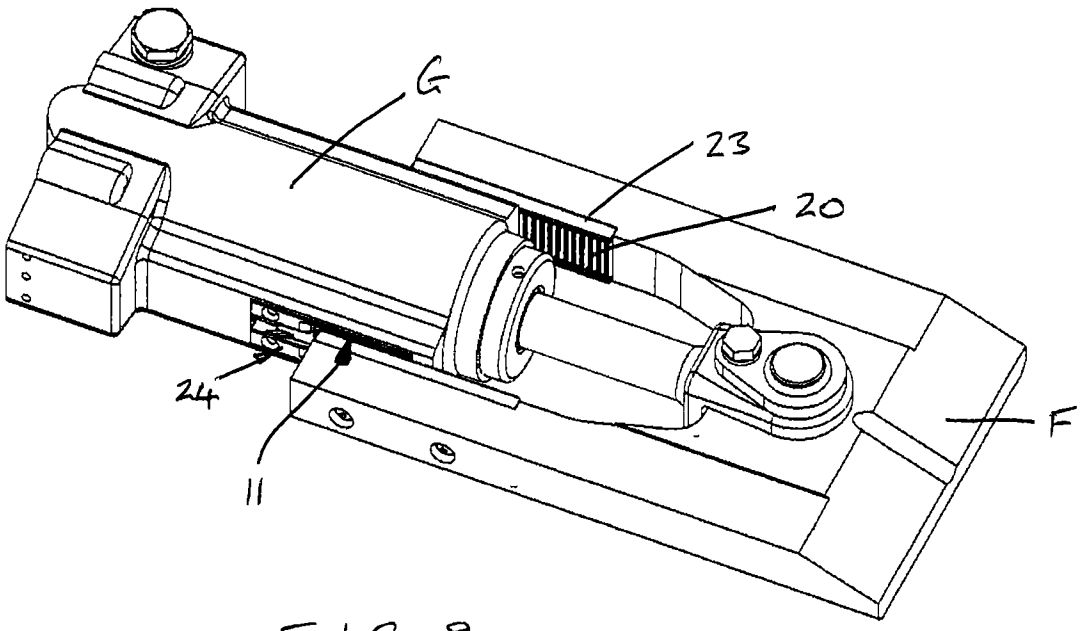
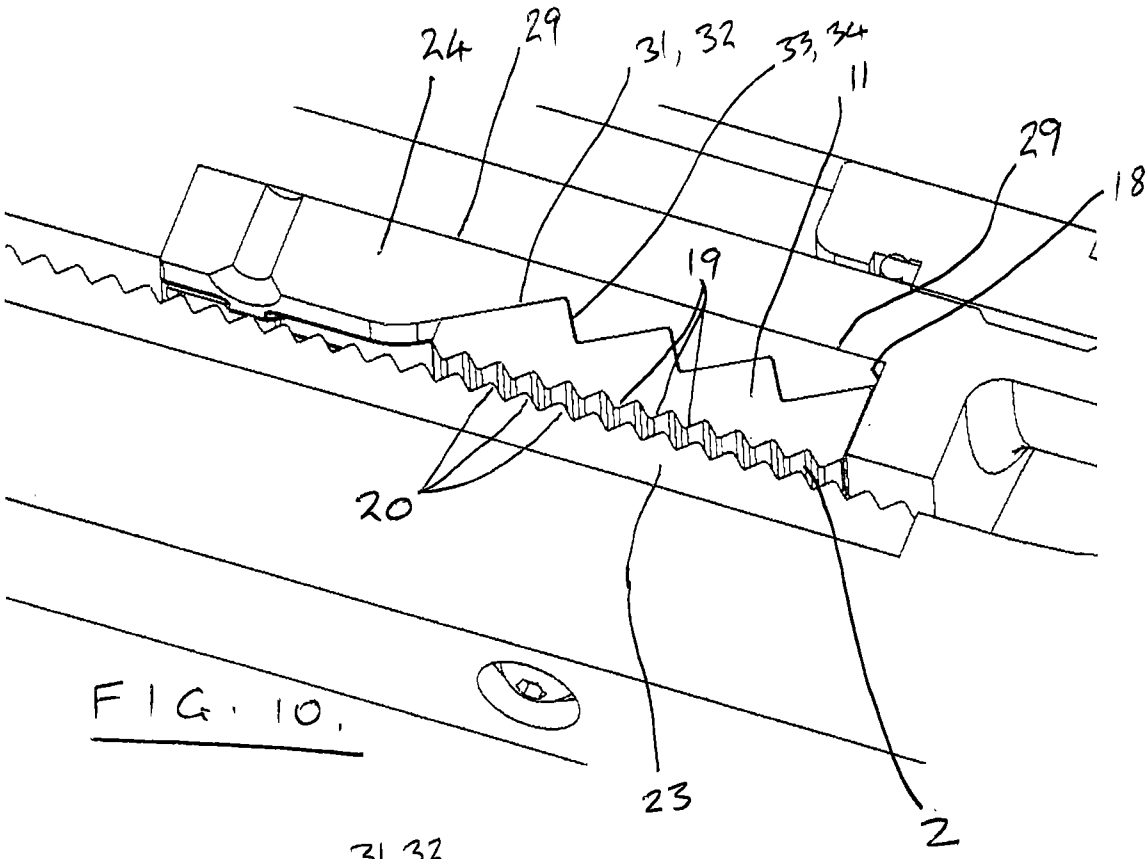


FIG. 9.


24
29
31, 32
33, 34
11
29
18
19
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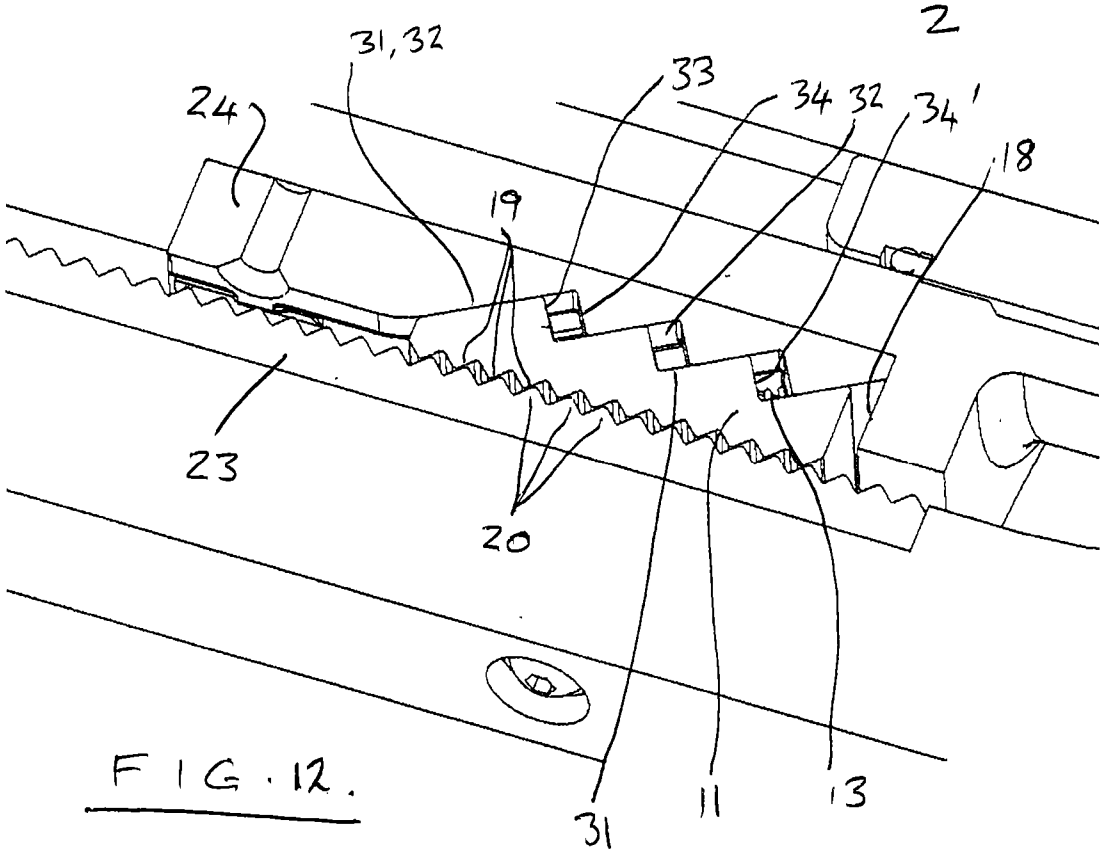
23
2

FIG. 10.


31, 32
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31
11
13

FIG. 12.

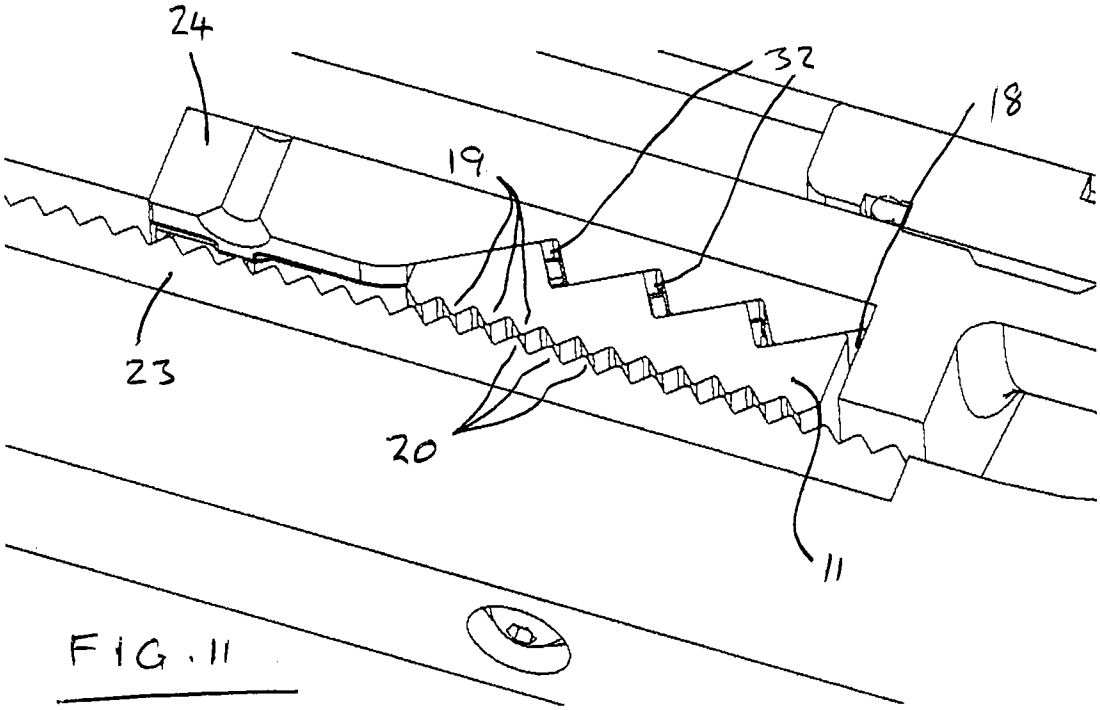

FIG. 11

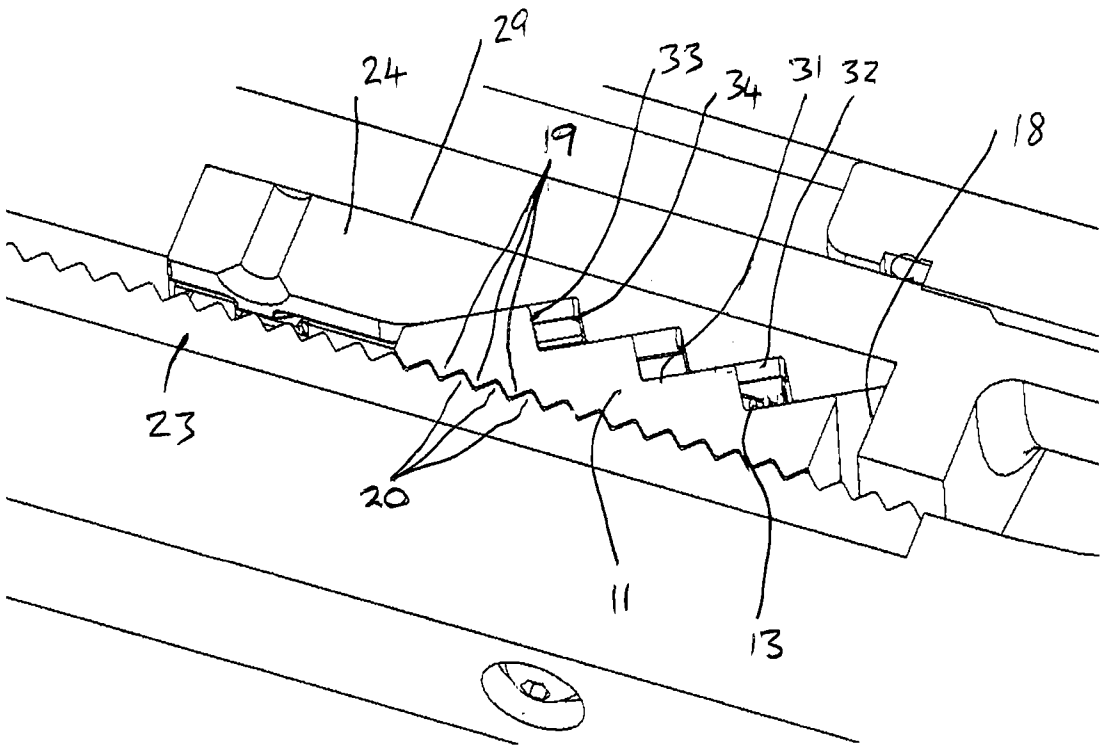

FIG. 13.

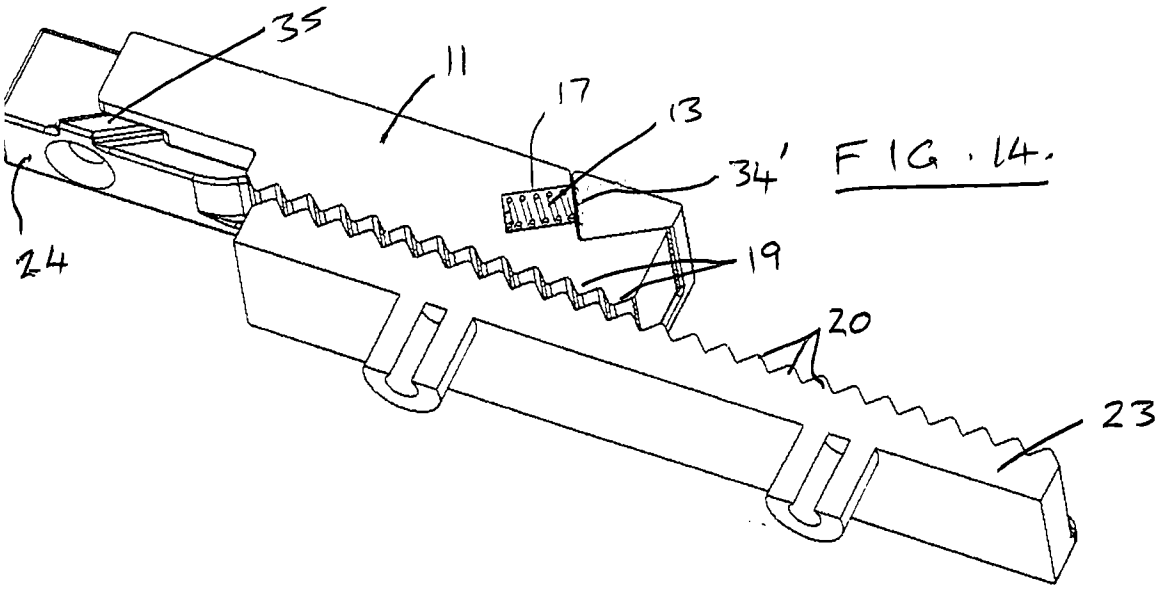

FIG. 14.

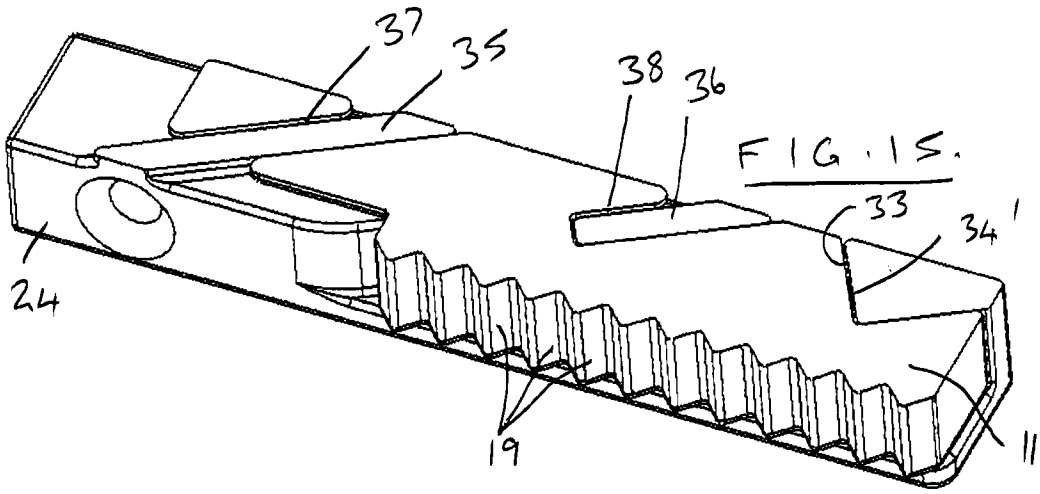

FIG. 15.

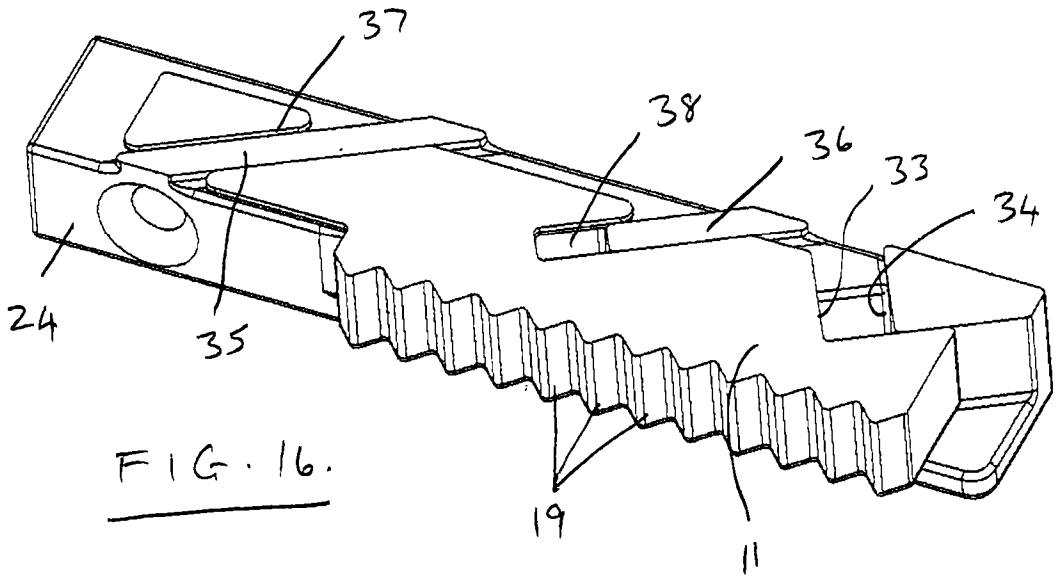

FIG. 16.

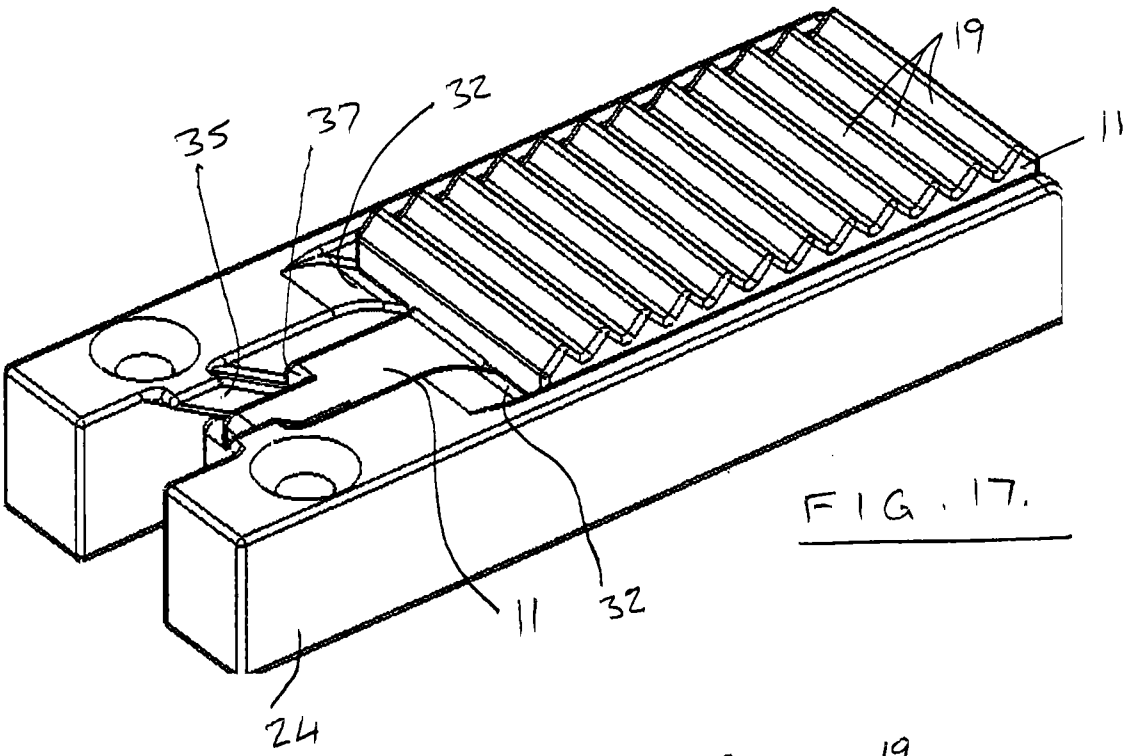

FIG. 17.

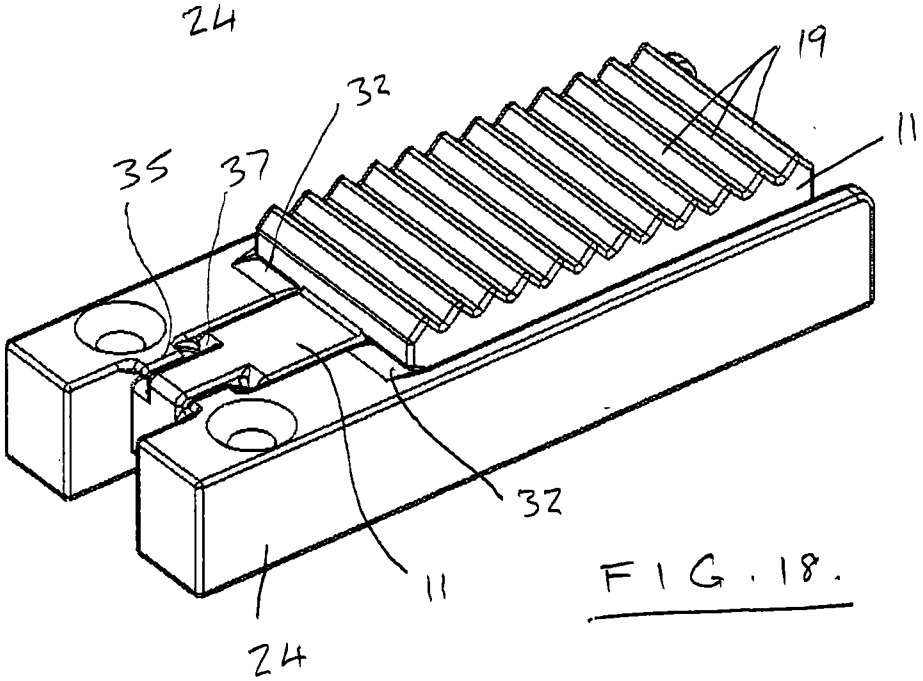

FIG. 18.

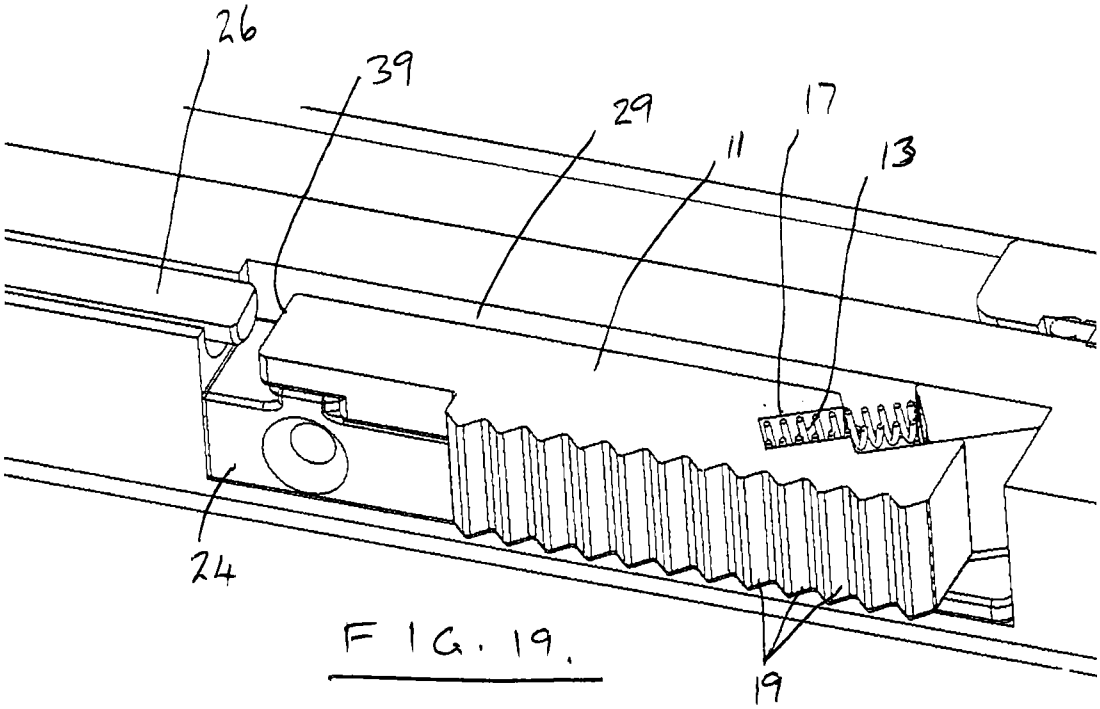

FIG. 19.

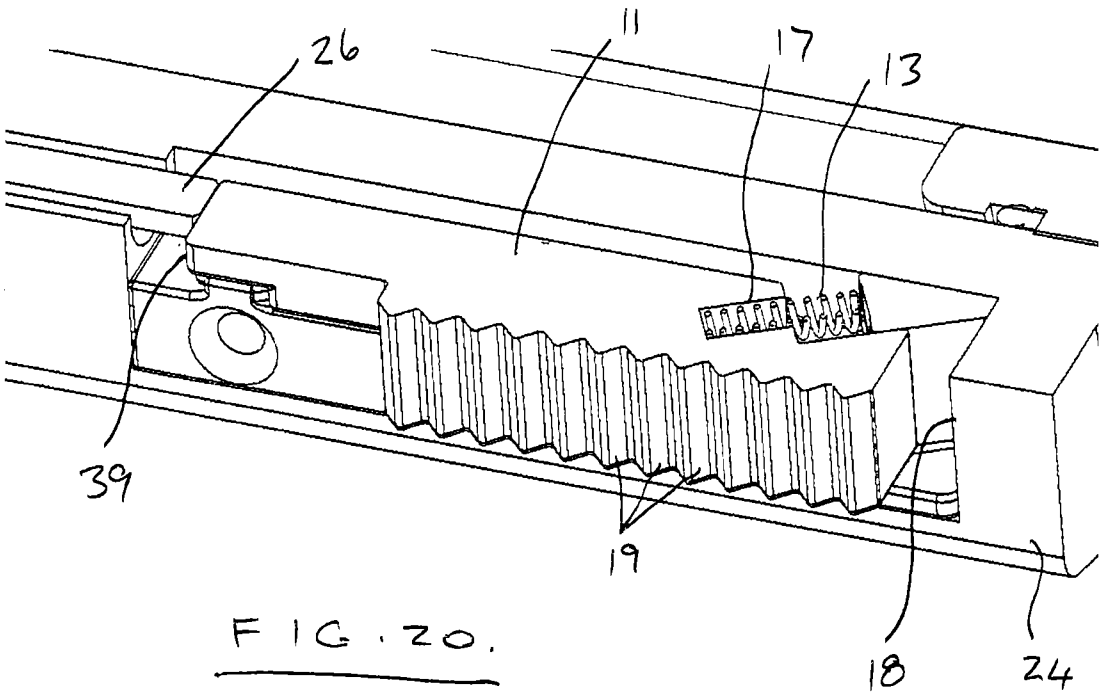

FIG. 20.

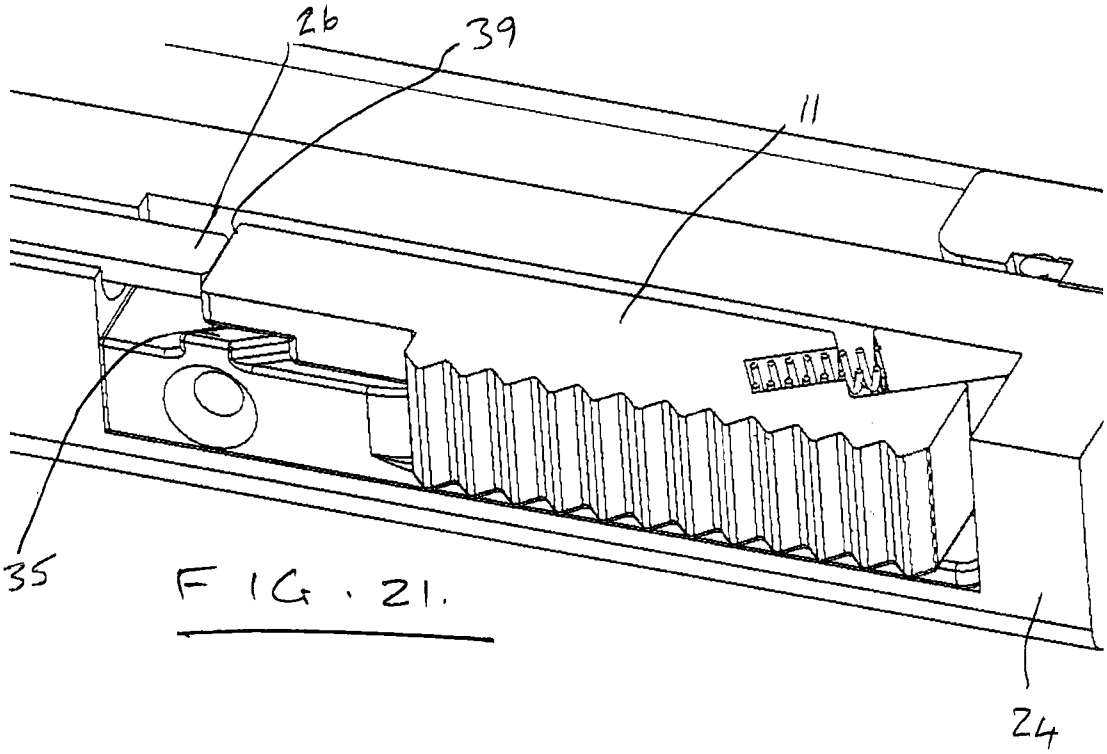

FIG. 21.

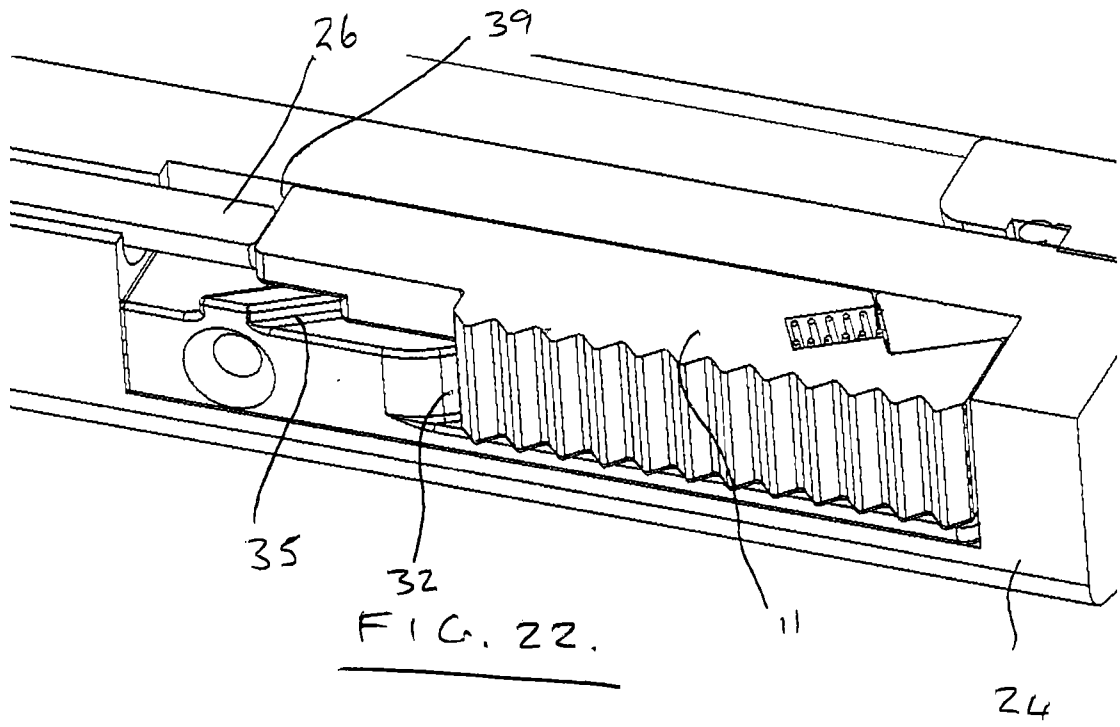

FIG. 22.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ2013/000219

A. CLASSIFICATION OF SUBJECT MATTER

E02F 3/36 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI, TXTE: /IPC/CPC E02F3/- and Keywords couple, grab, hitch, lock, latch, safety, failure, accident, injury, wedge, taper, incline, slope, angular, tooth, serration, teeth, ratchet, jaw, catch, linear, slide, travel, move, bias, spring, urge, force and the like.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 February 2014	19 February 2014

Name and mailing address of the ISA/AU

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Authorised officer

Weifeng Cheng
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Telephone No. 0262832843

INTERNATIONAL SEARCH REPORT C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		International application No. **PCT/NZ2013/000219**
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 7654019 B2 (YEAGER et al.) 02 February 2010 the whole document	1-20
A	US 2010/0247228 A1 (MONAGHAN et al.) 30 September 2010 the whole document	1-20
A	US 2012/0189380 A1 (DOHERTY et al.) 26 July 2012 the whole document	1-20
A	US 2012/0266432 A1 (BALEMI) 25 October 2012 the whole document	1-20

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ2013/000219

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
the subject matter listed in Rule 39 on which, under Article 17(2)(a)(i), an international search is not required to be carried out, including

2. ☒ Claims Nos.: **21-22.**
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
See Supplemental Box

3. ☐ Claims Nos:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT	International application No. PCT/NZ2013/000219

Supplemental Box

Continuation of **Box II**

The claim/s do/does not comply with Rule 6.2(a) because it/they rely on references to the description and/or drawings.

INTERNATIONAL SEARCH REPORT Information on patent family members	International application No. **PCT/NZ2013/000219**

This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document/s Cited in Search Report		Patent Family Member/s	
Publication Number	**Publication Date**	**Publication Number**	**Publication Date**
US 7654019 B2	02 Feb 2010	CA 2634070 A1	12 Sep 2008
		US 2008296031 A1	04 Dec 2008
		US 7654019 B2	02 Feb 2010
US 2010/0247228 A1	30 Sep 2010	CA 2702853 A1	23 Apr 2009
		EP 2215309 A1	11 Aug 2010
		GB 2446485 A	13 Aug 2008
		GB 2446485 B	14 Jan 2009
		GB 2447809 A	24 Sep 2008
		GB 2447809 B	18 Feb 2009
		NZ 584772 A	25 May 2012
		US 2010247228 A1	30 Sep 2010
		WO 2009050445 A1	23 Apr 2009
US 2012/0189380 A1	26 Jul 2012	CA 2813185 A1	07 Apr 2011
		EP 2483480 A1	08 Aug 2012
		US 2012189380 A1	26 Jul 2012
		WO 2011040824 A1	07 Apr 2011
US 2012/0266432 A1	25 Oct 2012	CA 2783802 A1	16 Jun 2011
		CN 102782220 A	14 Nov 2012
		EP 2510159 A1	17 Oct 2012
		KR 20120110113 A	09 Oct 2012
		US 2012266432 A1	25 Oct 2012
		WO 2011071394 A1	16 Jun 2011

End of Annex

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.