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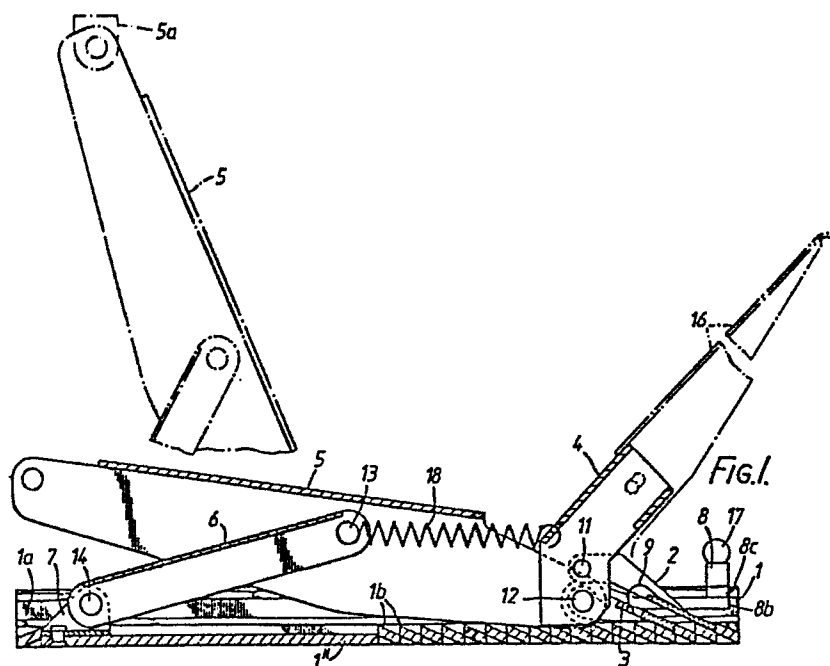
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(64) Ratchet operated jacks.

(57) The jack comprises a base (1) having a rack (1c), an inverted U-section load lifting arm (5) slidable horizontally on a pivot pin (12) in guide channels (1a) of the base (1), a strut (6) pivoted to the lifting arm (5) and to the base (1), a jacking arm (4) pivoted on the pin (12) and carrying a jacking pawl (2) which co-operates with the rack (1c) to lift the load in steps and a locking pawl (3) which transfers the load on the lifting arm (5) to the rack (1c) between the stepwise jacking movements. During load lowering, the pawls (2, 3) are alternately raised by a spring (9) and during load raising the action of spring (9) is overcome and both pawls (2, 3) are biased into engagement with the rack (1c) by a raising spring (8). Preferably, a slider (30) automatically pivots the spring (8) to an inoperative position when the jack is fully raised and into an operative position when the jack is fully lowered.



RATCHET OPERATED JACKS

The present invention comprises improvements in ratchet operated jacks, e.g. for motor vehicles.

It is known to provide a ratchet operated jack of a kind comprising a base having a rack extending along the base, a lifting arm constrained at its lower end to slide horizontally along the base, a strut pivoted to the lifting arm and to the base, a pivoted jacking arm carrying a jacking pawl which co-operates with the rack to shift the lower end of the lifting arm towards the strut/base pivot to raise the upper end of the lifting arm and a locking pawl which transfers the horizontal component of load on the lifting arm to the rack.

Known jacks of this kind tend to be either somewhat massive in construction or to fail due to overstressing or damage to the rack teeth.

The present invention provides, from one aspect, a ratchet operated jack as described in the next but one preceding paragraph in which the lower end of the lifting arm is constrained to slide horizontally by means of guided channels in upstanding side walls of the base, the guide channels reacting the vertical load on the lifting arm.

Preferably, in a jack according to the present invention, the lower end of the lifting arm is constrained by the jacking arm pivot, opposite ends of which are slidably received in respective ones
5 of said guide channels. This enables the number of parts and the overall weight of the jack to be reduced.

Preferably also, in a jack according to the present invention, the base is a channel-form extrusion e.g. of aluminium, and the rack teeth are pressed
10 or extruded from out of the channel floor. By forming the base in one piece, the number of parts and the overall weight of the jack are still further reduced.

Preferably also, in a jack according to the present invention, the rack teeth are formed with a
15 large bearing area and the angle of incidence of the locking pawl to the rack is in the range of 20° to 30° and preferably about 22° . This reduces the vertical component of the forces on the rack teeth
20 to about one third the horizontal force and spreads the load on the teeth.

In a ratchet operated jack of the known kind described at the beginning, it is usual to provide a a spring interconnecting the jacking and locking
25 pawls and to bias the spring with a lever thereby to

spring press the pawls into engagement with the rack when raising the upper end of the lifting arm. When lowering a load on the jack the unbiased spring operates the pawls so as always to lift the unloaded pawl.

5 This arrangement gives rise to certain difficulties, however, leading to burring of the rack teeth and failure of the jack, more particularly due to the fact that the biasing of the spring to operate the pawls to lift a load on the jack gives the spring
10 a permanent set so that the spring no longer operates correctly when lowering a load.

The present invention provides from a further aspect, a ratchet operated jack of the known kind described at the beginning including a lowering
15 spring inter-engaged between the jacking and locking pawls for raising the unloaded pawl during a load lowering operation and a raising spring or springs movable into and out of contact with the pawls to overcome the action of the lowering spring and bias
20 both pawls into engagement with the rack.

Specific embodiments of the present invention will now be described by way of example, and not by way of limitation, with reference to the accompanying drawings in which :-

25 FIG. 1 is a sectional side elevation of a

jack in accordance with the present invention, shown with its lifting arm in its fully raised and fully lowered positions;

FIG. 2 is a right hand end view of the jack shown in Fig. 1 with the lifting arm in its fully lowered position;

FIGS. 3 to 20 are details of certain of the parts of the jack of Fig. 1, excluding, e.g. the base, the strut, and the handle or foot pedal;

FIGS. 21 to 24 are diagrams showing the operation of the lowering and raising springs;

FIG. 25 is a sectional side elevation of a further jack in accordance with the present invention;

FIG. 26 is a view in the direction of arrow 26 in Fig. 25;

FIG. 27 is a right hand end view of the jack shown in Fig. 25; and

FIGS. 28 to 30 show details of certain of the parts of the jack shown in Figs. 25 to 27.

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Throughout the drawings, like parts are indicated by the same reference numerals and/or reference letters.

With reference now to the accompanying
5 drawings, and first with reference to Figs. 1 and 2,
the jack comprises an extruded aluminium base 1 of
channel section and having opposite side wall guide
channels 1a (see also Figs. 23 and 24) in its side
walls 1'. The channel floor 1" of the base is formed
10 with rack teeth 1b pressed up from the material of the
floor of the base, the teeth 1b forming a rack generally
indicated 1c and extending along the base. A
lifting arm 5 (see also Figs. 3 and 4) is
constrained at its lower end by a pin 12
15 to slide horizontally along the base, the
pin 12 engaging with flats 12a (see Figs. 15 and 16)
at opposite ends against upper horizontal walls of
the guide channels 1a of the base, via Glacier DU

material bearingpads 10 (see Figs. 17 and 18). A strut 6 is pivoted to a mid-point of the lifting arm 5 by means of a pin 13 and to the back end of the base 1, via a trunnion 7, by means of a pin 14.

5 A jacking arm 4 is pivoted on the pin 12 and carries a jacking pawl 2 (see also Figs. 7 and 8) pivoted on a pin 11 eccentric to the pin 12 and disposed vertically above it in the raised position of the handle or foot pedal 16 which is removably attached
10 to the jacking arm in use of the jack. On lowering of the handle or pressing down of the foot pedal, the pawl 2 is loaded in engagement with a tooth 1b of the rack to shift the lower end of the arm 5 towards the strut 6/base 1 pivot 14 to raise the upper end of
15 the lifting arm 5 which is provided with a suitable lifting attachment 5a. In the rest position, the horizontal component of the load on the lifting arm is taken by a locking pawl 3 which transfers it to the rack. A lowering spring 9 (see also Figs. 11 and
20 12) is interengaged between the jacking and locking pawls 2 and 3 for raising the unloaded pawl 2 or 3 during a load lowering operation to "walk" the pawls back along the rack, i.e. as the handle
16 is pumped up and down. This operation
25 will be described in detail below with reference to Figs. 21 and 22. A raising spring 8 (see also Figs.

13 and 14) carrying a manipulating knob 17 for moving the spring into and out of contact with the pawls 2 and 3 overcomes the action of the spring 9 and biases the pawls 2 and 3 into contact with the rack 1c during a raising operation. The spring 8 is pivoted on the pin 12 for raising and lowering movements of its spring arm 8a (see Figs. 14, 23 and 24) out of and into contact with tangs 2a, 3a on the respective pawls 2 and 3. The spring 8 has a flexible lever portion 8b carrying the knob 17 for raising and lowering the spring arm 8a. A bight 8c (see also Figs. 23 and 24) of the lever portion 8b hooks onto a lip 1d of the side wall of the base channel to hold the spring arm 8a in its lowered, i.e. operative position. The lever portion is deflected sideways and pulled up by its knob 17 to move the spring to its inoperative position for lowering the jack.

Referring now to Figs. 21 and 22, during a load lowering operation, the raising spring 8 is in its inoperative position shown in fig. 23, out of contact with the pawls 2 and 3. The lowering spring 9 which is fixedly carried by the pawl 2 in this example, has a downwardly curving portion 9a which passes between the pivot arms 2b of the pawl 2 around

a rear edge 2c of the pawl 2 and through a rectangular opening 3b in the pawl 3. When the handle is in the fully raised position the spring 9 presses against the upper edge of the opening 3b in the pawl 3 to lift the upper pawl 2 or to press down the lower pawl 3 dependent on which pawl 2 or 3 is carrying the load. When the handle is in its fully lowered or horizontal position, in which it is angularly displaced downwardly by 45° in this example, the spring 9 pulls against the lower edge of the opening 3b in the pawl 3 to pull down the upper pawl 2 or to raise the lower pawl 3 dependent on which is carrying the load. Thus, when the jack is in a rest position supporting a load, and the locking pawl 3 is taking the horizontal component of the reaction force, the spring 9 supports the pawl 2 clear of the rack and lowering the handle moves the spring 9 into engagement with the lower edge of the opening 3b to pull down the pawl 2 into engagement with the rack as the handle reaches its lowered position. The pawl 2 then takes the horizontal load and the spring 9 lifts the lower pawl 3 clear of the rack. The load on the jack is reacted by the operator as he again raises the handle and the load on the jack descends. The upper

edge of the opening 3b engages the spring 9 to press the pawl 3 into engagement with the rack as the handle again reaches its raised position. The horizontal load is again taken by the pawl 3 and
5 the pawl 2 is raised clear of the rack and the operation repeated until the jack is fully lowered.

For foot pedal operation a coil spring 18 is provided acting between the pivot pin 13 and the
10 jacking arm 4 to elevate the foot pedal during a load raising operation.

Referring now to Figs. 25 to 30, the jack there shown corresponds in construction with the jack described with reference to Figs. 1 to 24 with the
15 following modifications which will alone be described.

A modified foot pedal 16' is foldable to the chain-dotted position shown in Fig. 25 in the storage position of the jack.

The spring 8 lever portion 8b' is modified
20 to engage, with a free-end, inverted 60° V-formation 8b'' of the lever portion in one or other of two recesses 30a and 30b of a slider 30 mounted for sliding movement along the lip 1d of one of the channel side walls 1'. The recess 30b is narrower
25 than the recess 30a and holds the lever portion 8b' of

the spring 8 depressed such that the spring arm 8a is held in its lowered position as previously described, in spring biasing contact with the tangs 2a, 3a of the pawls 2 and 3. When the formation 8b" is entered in the wider recess 30a the spring arm 8a assumes its raised position as previously described out of spring biasing contact with the tangs 2a, 3a. The pawls 2, 3 are then operated by the spring 9 as previously described.

10 The formation 8b" shifts from recess 30b to recess 30a and from recess 30a to recess 30b automatically when the slider 30 engages an abutment 31 or 32 carried at the inside of the top edge of the channel side wall 1' mounting the slider for
15 sliding movement. The abutments may take any convenient form, e.g. one or other of them or both of them may be constituted by an impact screw. One of the abutments may be pressed from the material of the base. Thus, the slider 30 is conveniently formed
20 as a die-casting and slid onto the base side wall from one end.

 The abutment 31 is positioned to be engaged by the slider 30 when, in the lifting direction, as seen in Fig. 29, which is a view on arrow 29 in
25 Fig. 28, the locking pawl 3 is engaging the

penultimate rack tooth 1b at the left hand end of the rack 1c as seen in Fig. 25. On the final depression of the foot pedal 16' to shift the locking pawl one further tooth 1b during a load raising operation, the
5 formation 8b" shifts automatically from the recess 30b to the recess 30a, ready for lowering the load, as seen in Fig. 30, which is a view on arrow 30 in Fig. 28.

In a similar way, the abutment 32 is
10 positioned to be engaged by the slider 30 when, in the lowering direction, the jacking pawl 2 is engaging the penultimate rack tooth 1b at the right hand end of the rack 1c as seen in Fig. 25. On the final raising of the foot pedal during the lowering
15 operation, e.g. under the action of the spring 18 if not the load, the formation 8b" shifts automatically back into the recess 30b ready for raising.

Pressing the rack teeth 1b from the base
20 enables a large bearing area for each tooth to be produced without adding to the weight of the base which is already made of lightweight material.

The lifting arm is preferably designed to bend under excess load so that the arm deforms to
25 cause progressive failure as overload is applied to the

jack. This acts as a safety feature.

To improve its stability the jack may be provided with a foot at the lifting end, as seen in Fig. 2, extending at right angles to the base.

5 Since the lifting arm 5 is of inverted U-section and houses the strut 6 in the storage position of the jack, the strut then lying along the base between the side walls of the base, a compact storage position is achieved.

CLAIMS:

1. A ratchet operated jack comprising a base
(1) having a rack (1c) extending along the base, a
lifting arm (5) constrained at its lower end to slide
5 horizontally along the base, a strut (6) pivoted to
the lifting arm (5) and to the base (1), a pivoted
jacking arm (4) carrying a jacking pawl (2) which
co-operates with the rack (1c) to shift the lower
end of the lifting arm (5) towards the strut/base
10 pivot (14) to raise the upper end of the lifting arm
(5) and a locking pawl (3) which transfers the
horizontal component of load on the lifting arm (5)
to the rack (1c) characterized in that the lower end
of the lifting arm (5) is constrained to slide
15 horizontally by means of guide channels (1a) in
upstanding side walls of the base (1), the guide
channels reacting the vertical load on the lifting
arm (5).

2. A jack as claimed in claim 1 in which the
20 lifting arm (5) is of inverted U-section and houses
the strut (6) in the storage position of the jack,
the strut then lying along the base (1) between the
side walls of the base.

3. A jack as claimed in claim 1 or 2 in
25 which the jacking arm (4) is adapted for operation by

a foot of the user.

4. A jack as claimed in any preceding claim in which the lower end of the lifting arm (5) is constrained by the jacking arm pivot (12) opposite
5 ends of which are slidably received in respective ones of said guide channels (1a).

5. A jack as claimed in any preceding claim in which the base (1) is formed in one piece as a channel-form extrusion the rack teeth (1b) being
10 press-formed out of the channel floor.

6. A jack as claimed in any preceding claim in which the rack teeth (1b) are formed with a large bearing area, the teeth (1b) having a width about one
half that of the base (1) between the side walls
15 thereof and the angle of incidence of the locking pawl (3) to the rack (1c) is in the range of 20° to 30° .

7. A ratchet operated jack comprising a base (1) having a rack (1c) extending along the base, a
20 lifting arm (5) constrained at its lower end to slide horizontally along the base, a strut (6) pivoted to the lifting arm (5) and to the base (1), a pivoted jacking arm (4) carrying a jacking pawl (2) which co-operates with the rack (1c) to shift the lower end
25 of the lifting arm (5) towards the strut/base pivot

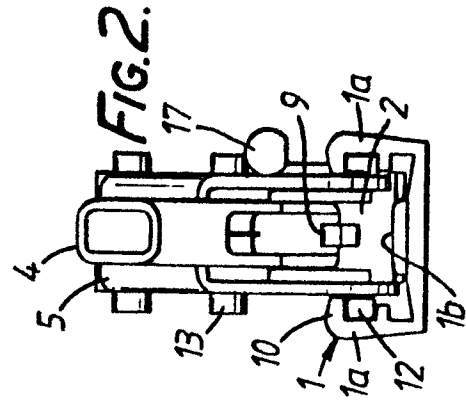
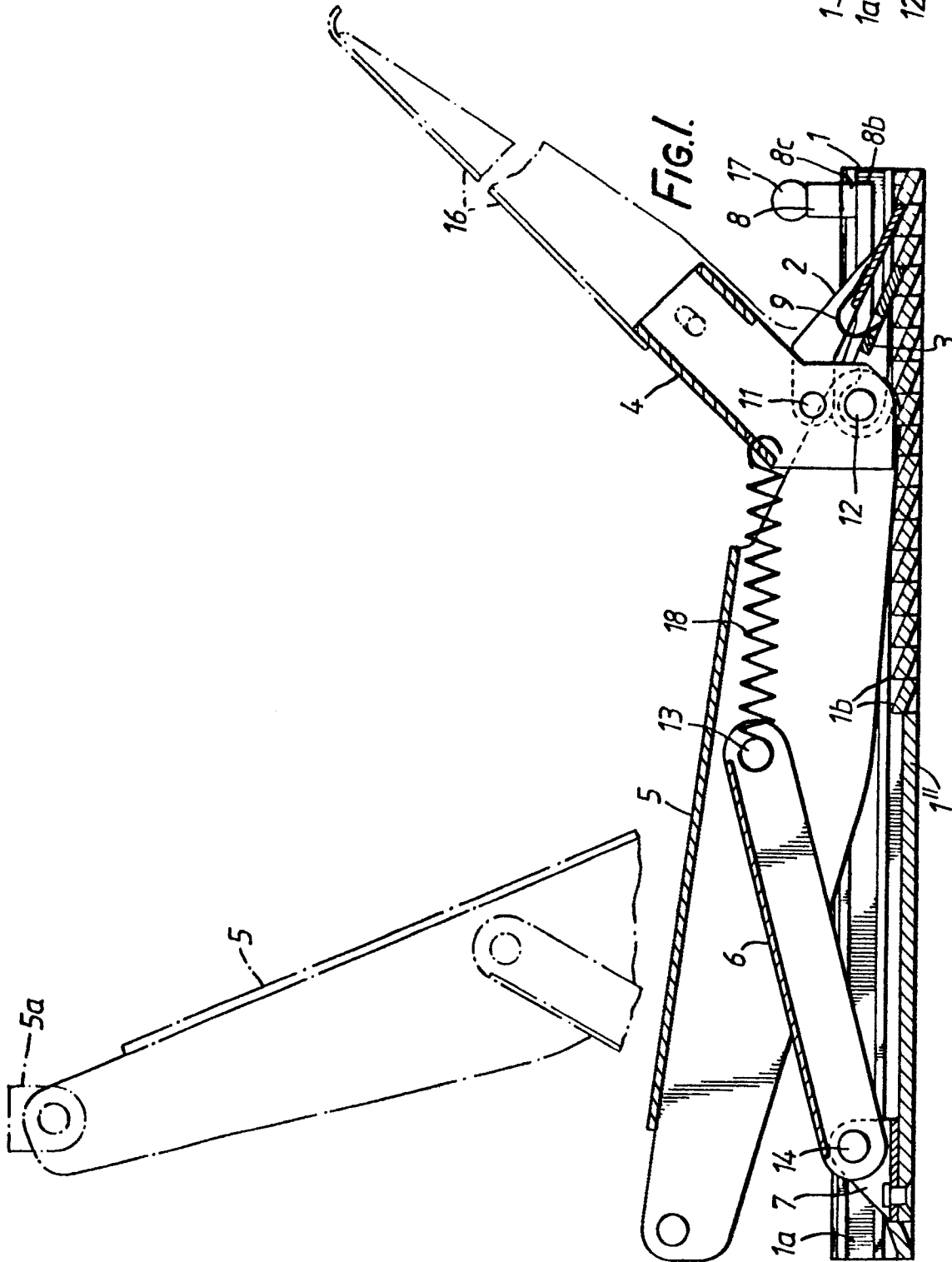
(14) to raise the upper end of the lifting arm (5) and a locking pawl (3) which transfers the horizontal component of load on the lifting arm (5) to the rack (1c) characterized by a lowering spring (9) inter-
5 engaged between the jacking and locking pawls (2, 3) for raising the unloaded pawl during a load lowering operation and a raising spring (8) or springs movable into and out of spring biasing contact with the pawls (2,3) to overcome the action of the lowering spring (9) and
10 bias both pawls into engagement with the rack (1c).

8. A jack as claimed in claim 7 in which the lowering spring (9) is carried by the locking pawl (2) and engages alternately with an opposed pair of edges of the locking pawl (3) respectively to lift
15 the jacking pawl (2) or depress the locking pawl (3) and to lift the locking pawl (2) or depress the jacking pawl (3) when the jacking arm (4) is in its raised and lowered positions respectively, the lowering spring (9) acting always to lift the unloaded
20 pawl (2 or 3) relative to the rack (1c).

9. A jack as claimed in claim 7 or 8 in which a manually adjustable slider (30) is movable stepwise along the base (1) between a pair of abutments (31, 32) on the base by the action of the jacking arm (4),
25 the slider (30) being engaged by a lever portion (8b') of the raising spring (8) and having two

positions relative to said lever portion (8b') by
change of which the raising spring (8) is moved into
and out of spring biasing contact with the pawls (2,
3), the abutments (31, 32) acting to obstruct the
5 slider relative to the lever portion (8b') of
the raising spring (8) during each last stepwise
movement of the jacking arm (4) in the raising and
lowering modes of the jack whereby the raising spring
(8) is moved into spring biasing contact with the
10 pawls (2, 3) when the jack is fully lowered and out
of spring biasing contact with the pawls when the
jack is fully raised.

10. A jack as claimed in claim 9 in which the
lever portion (8b') of the raising spring has a
15 free-end inverted V-formation (8b'') which engages
in respective larger and smaller recesses (30a,
30b) in the slider (30) in the lowering and raising
modes of the jack.



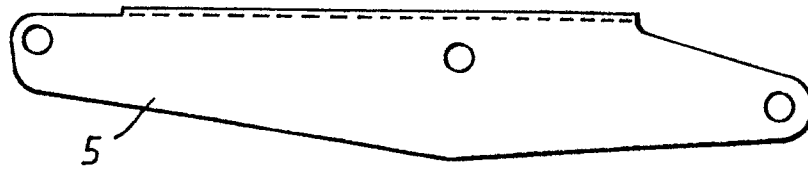


FIG. 3.

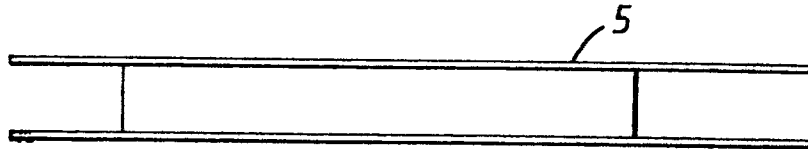


FIG. 4.

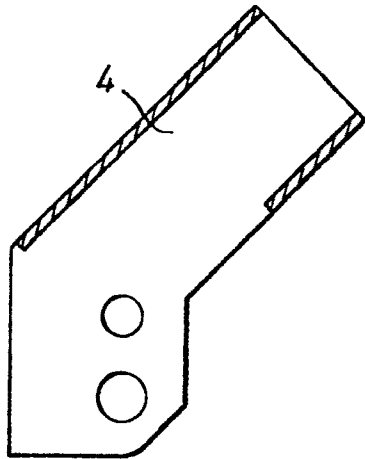


FIG. 5.

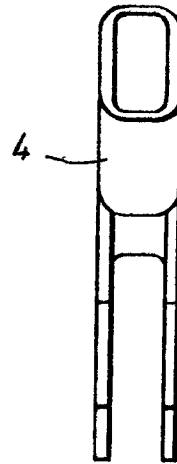


FIG. 6.



FIG. 11.

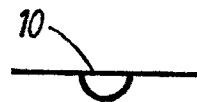


FIG. 17.



FIG. 18.

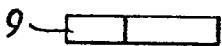


FIG. 12.

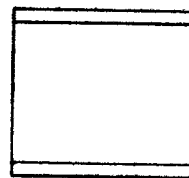


FIG. 19.

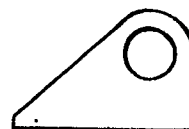


FIG. 20.

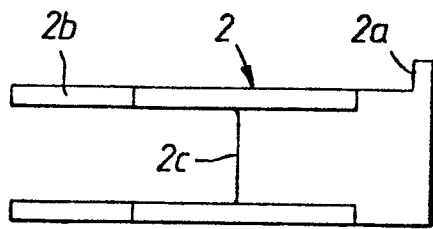


FIG. 7.

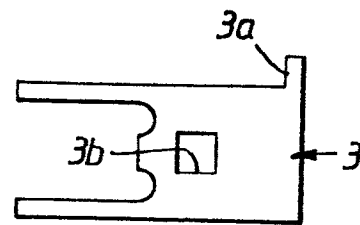


FIG. 9.

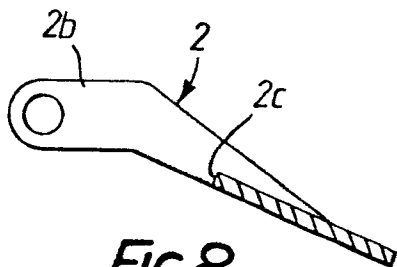


FIG. 8.

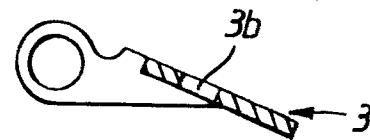


FIG. 10.

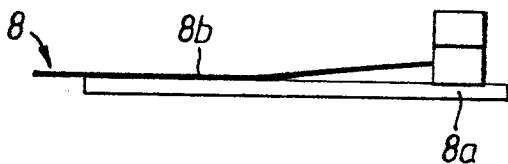


FIG. 13.

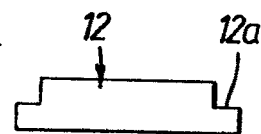


FIG. 15.

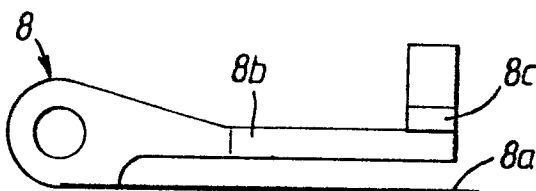


FIG. 14.

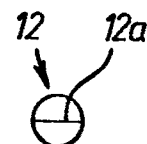


FIG. 16.

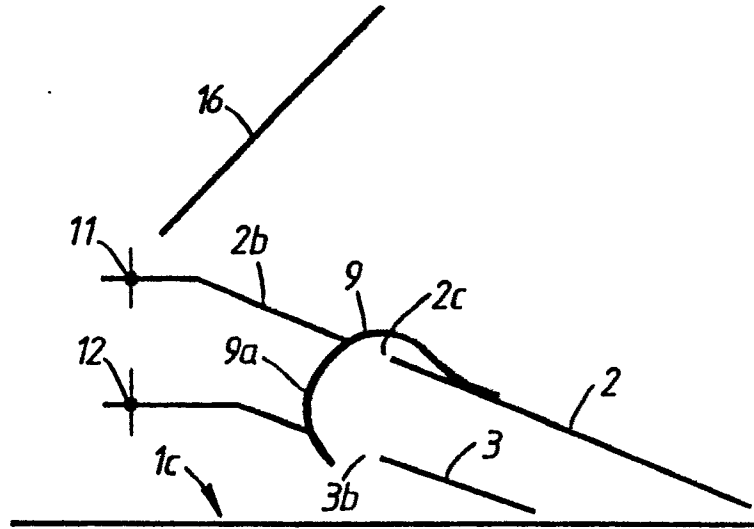


FIG. 21.

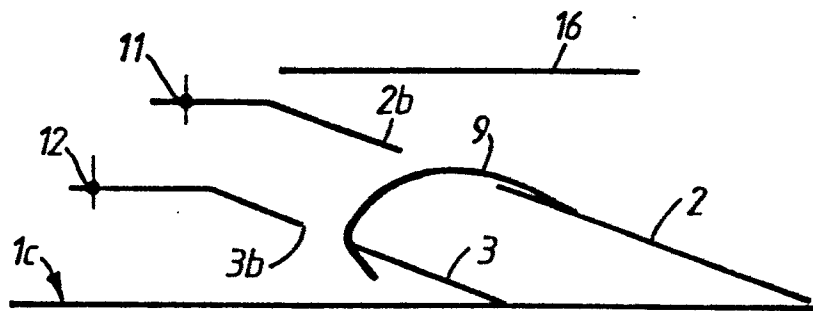


FIG. 22.

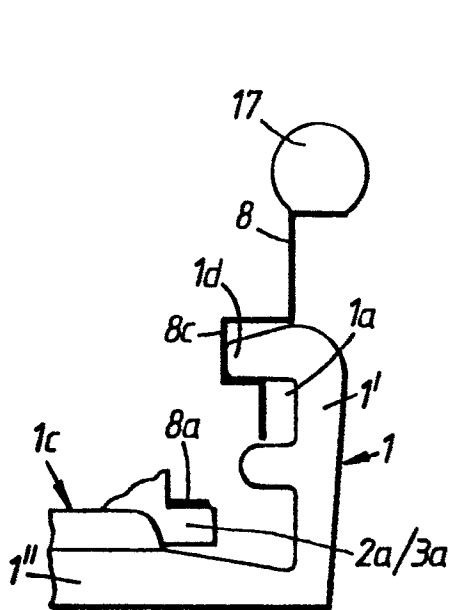


FIG. 23.

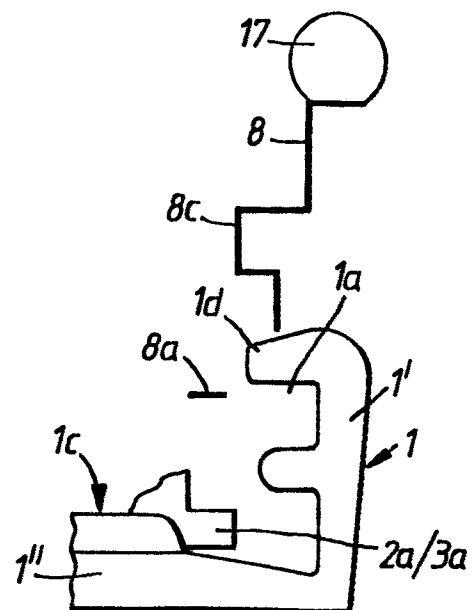
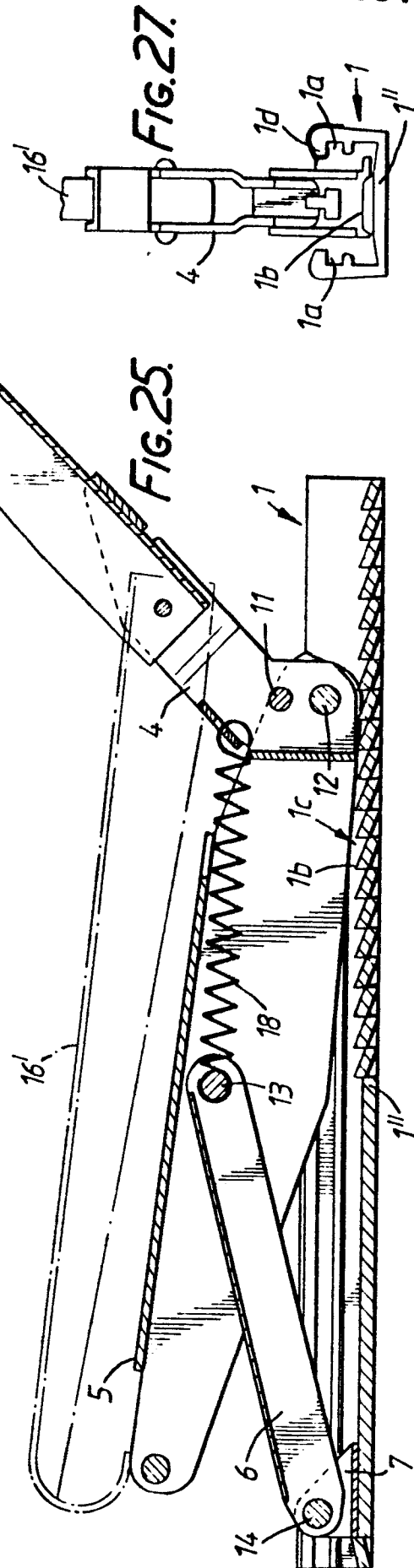
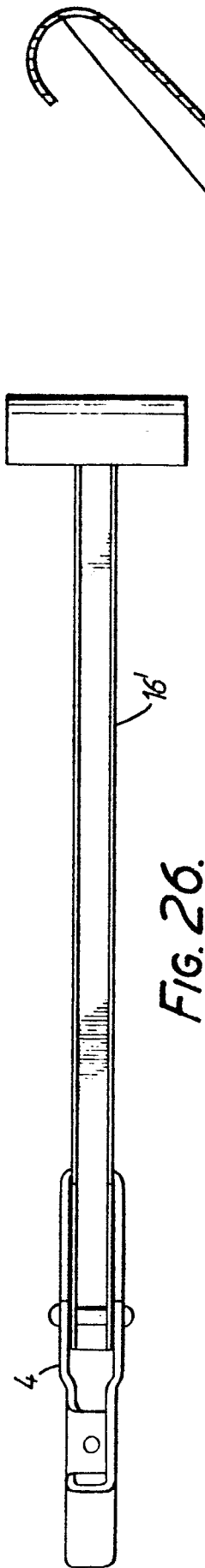


FIG. 24.



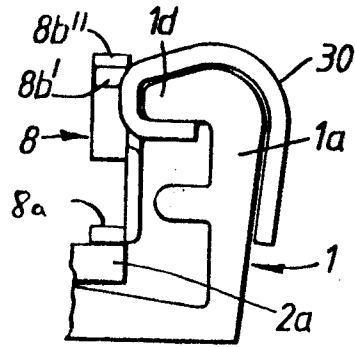


FIG. 28.

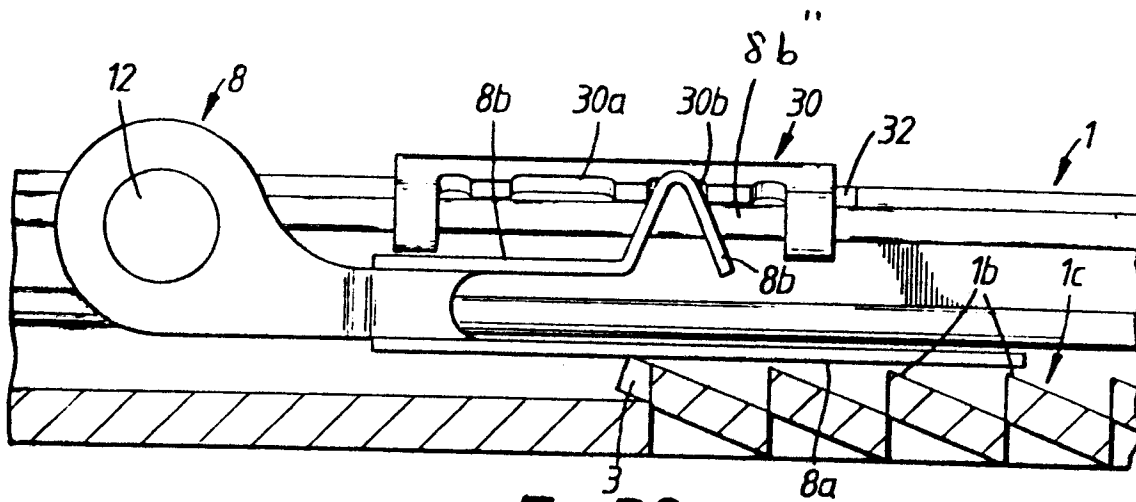


FIG. 29.

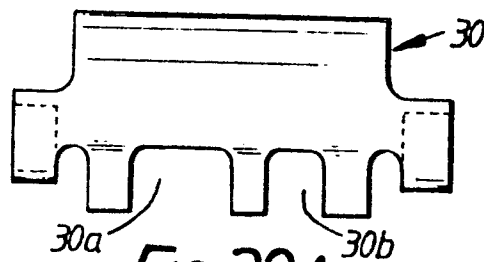


FIG. 29A.

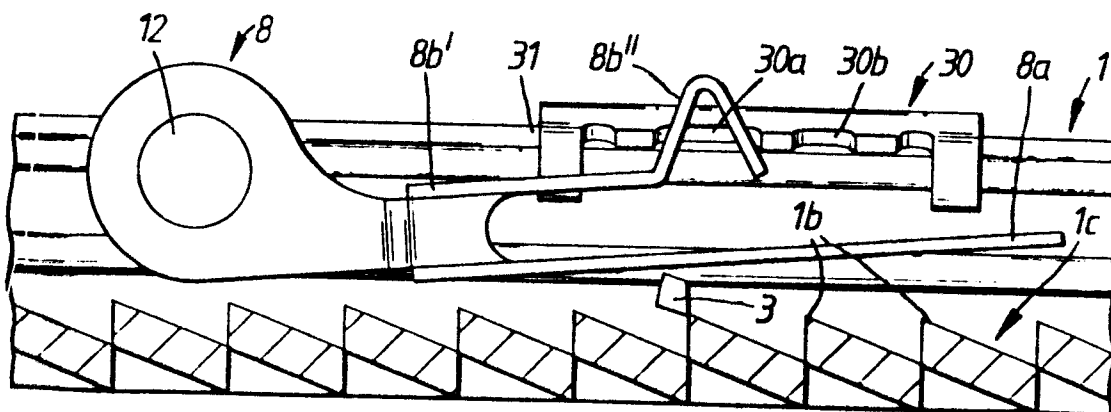


FIG. 30.