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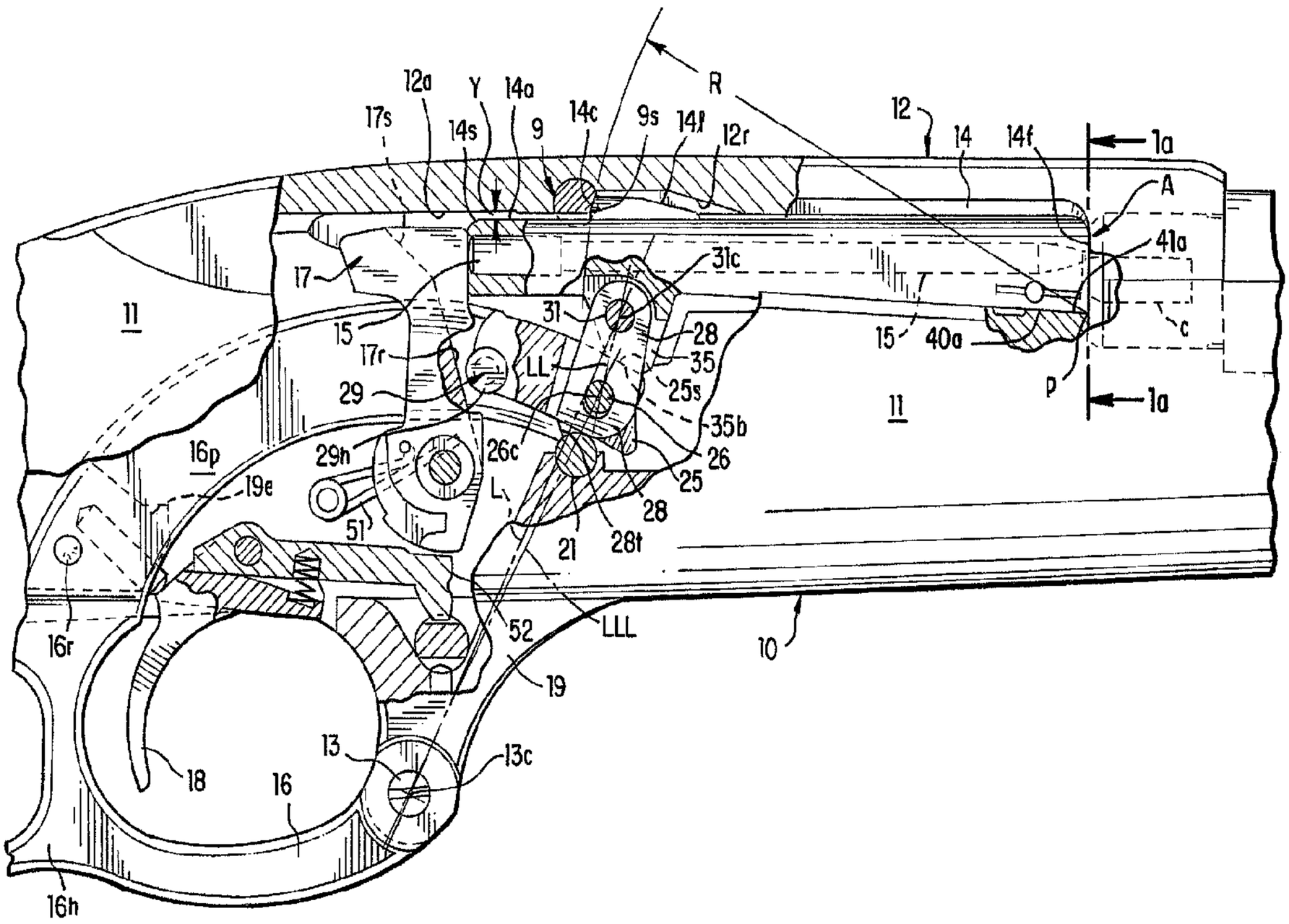
(54) Title: HAMMER COCKING AND BOLT LOCKING SYSTEM FOR LEVER OPERATING FIREARM



(57) Abrégé/Abstract:
A lever action firearm (10) having a receiver (12), a hammer (17), a lever pivotal (13) about a fixed point, a bolt (14) and a link (28) which link is pivotal on both the bolt and the lever. The pivotal lever includes first surface means to engage second surface means on the hammer to cause the hammer to be cammed back during unloading. The lever, link and bolt are configured such that when they are in the fire position and are subjected to forces of firing they function as a joint lock to prevent unloading of the bolt and lever. Locking surfaces on the receiver and bolt strengthen the joint lock at the moment of firing.

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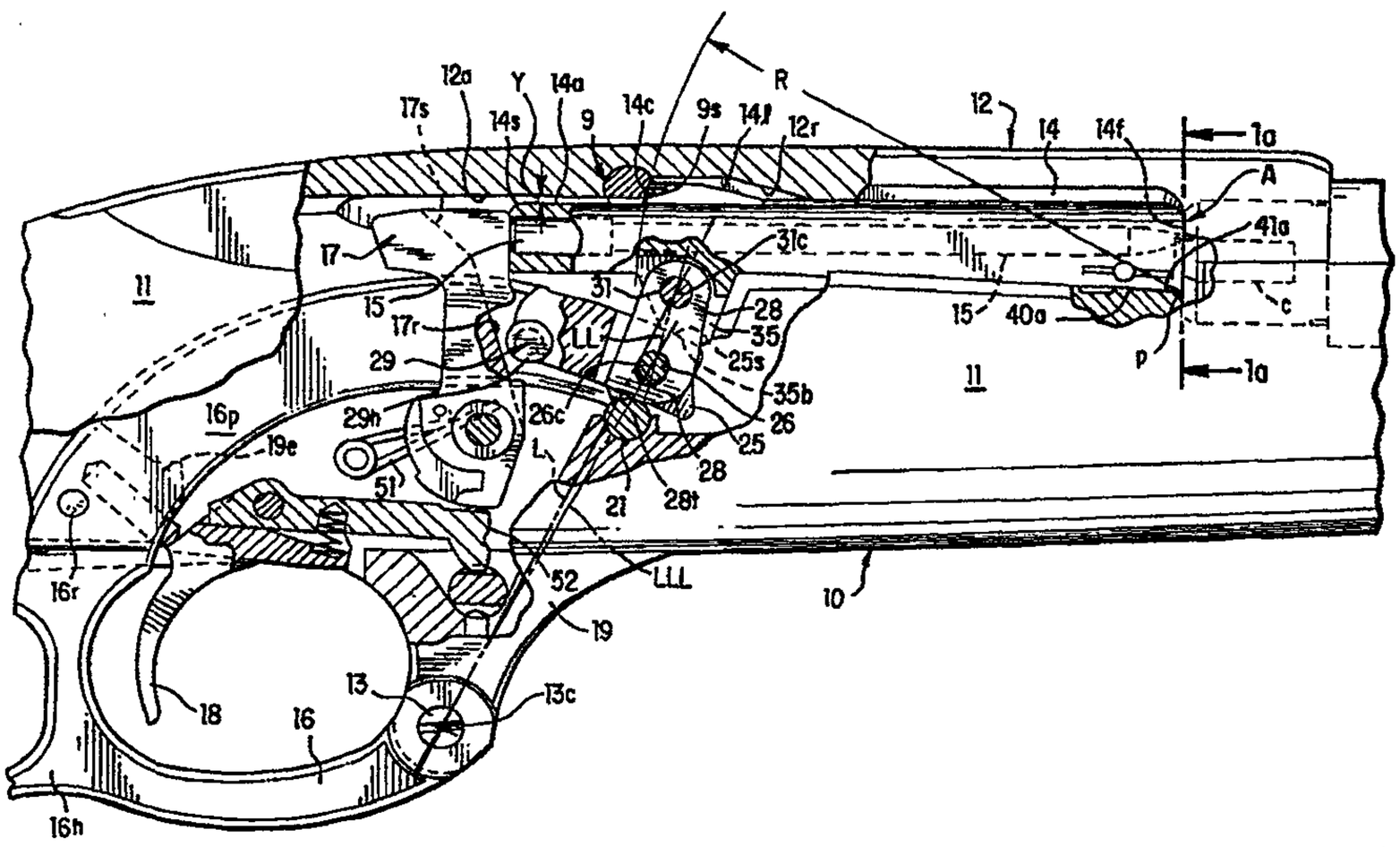

(57) Abstract

A lever action firearm (10) having a receiver (12), a hammer (17), a lever pivotal (13) about a fixed point, a bolt (14) and a link (28) which link is pivotal on both the bolt and the lever. The pivotal lever includes first surface means to engage second surface means on the hammer to cause the hammer to be cammed back during unloading. The lever, link and bolt are configured such that when they are in the fire position and are subjected to forces of firing they function as a joint lock to prevent unloading of the bolt and lever. Locking surfaces on the receiver and bolt strengthen the joint lock at the moment of firing.

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HAMMER COCKING AND BOLT LOCKING SYSTEM FOR LEVER OPERATING FIREARM

Background Of The Invention

Lever action firearms have included lever locking systems (U. S. Patent Nos. 10,535 and 502,018). Prior lever action rifles have used linkages to keep the bolt in proper position at the rear of the barrel during the forces generated from firing.

Summary Of The Invention

Broadly, the present invention is an improvement in lever action firearms in which the cocking lever is pivotally connected to the bolt through a relatively short link and in which the cocking lever or side pin extension thereof is engageable with a hammer surface to rotate the hammer back during opening of the lever. To facilitate bolt closing the rear of the bolt and a receiver recess interact to cause the bolt to be swung (upwardly and forwardly during the loading movement of the cocking lever; (2) downwardly and rearwardly as the bolt moves rearwardly immediately after firing; and (3) further downwardly and rearwardly as the cocking lever is manually swung to unload the firearm.

It is a feature of the invention that the cocking lever arm has one or more hammer engaging surfaces to engage the hammer to cause the hammer to be rotated back a sufficient distance during unloading to allow the hammer to move forward a short distance to engage the sear during loading. Such relationship between the cocking lever and hammer allows the hammer to move the lever and its attached bolt forward under certain conditions to assure closing of the bolt before firing.

It is a feature that the bolt engages the receiver along angled sliding surfaces in its locked position which causes, during firing and immediately thereafter, the bolt to move rearwardly and downwardly to increase the force necessary to

unlock the bolt thereby resisting unlocking when breach pressures are at their peak during firing. Because of the shallow angles on this locking projection lug, most of this force is against the receiver with a small amount of force constituting downthrust.

It is a further feature that the shape, configuration and proportion of the lever arm and link are such that immediately following firing when the rear of the bolt is moved downwardly a force is required to cause the lever and link to move from one side of such center line to the other side. During this period the bolt lock operates on a toggle joint or over-center principle.

Brief Description Of the Drawings

Fig. 1 is a partial right side elevational view of the lever action firearm of the present invention in its lever-closed hammer down position;

Fig. 1a is a sectional view taken along line 1a-1a of Fig. 1;

Fig. 2 is a view similar to Fig. 1 in which the firearm lever is in its fully open position;

Fig. 3a is a right side elevational view of the hammer in its fire position;

Fig. 3b is a front elevational view of the hammer in its fire position;

Fig. 3c is a left side view of the hammer in its fire position;

Fig. 4 is a partial right side elevational view showing a portion of Fig. 1;

Fig. 5 is a partial right side elevational view of the lever partially opened causing a lever pin to engage the hammer to cock it back;

Fig. 6 is a partial right side elevational view with the lever fully open and the hammer is fully cocked back;

Fig. 7 is an alternative embodiment in which the lever lacks a hammer engaging pin and in which the lever acts directly on the hammer;

Fig. 7a is a sectional view taken along line 7a-7a of Fig. 7;

Fig. 8 is a partial right side elevational view (without hammer) showing the lever in its forward closed position;

Fig. 8a is an alternative embodiment in which the recess is made of a hard material;

Fig. 9 is a partial right side elevational view showing the lever in a partial open position;

Fig. 10 is a partial right side elevational view showing the lever further opened and the bolt rotated down;

Fig. 11 is a sectional view taken along line 11-11 of Fig. 8; and

Fig. 12 is a sectional view taken along line 12-12 of Fig. 2.

Description Of The Preferred Embodiment

In Figs. 1-6, firearm 10, includes stock 11, receiver 12 with its pin section 9, bolt 14, angled bolt locking surface 14c on bolt projection lug 141, firing pin 15, cocking and bolt control lever 16, hammer 17, hammer striking surface 17c

in hammer recess 17r, trigger 18 and lever housing 19. Also shown are lever pivot pin 13, cartridge case C, receiver recess 12r, receiver cross pin locking shoulder 9s and forward and rearward housing cross pins 21 and 22 (see Fig. 5).

Turning to Fig. 3a-c, hammer 17 includes hammer body 17b, hammer recess 17r and hammer cam surface 17s.

Cocking lever 16, pivoted about lever pivot pin 13 on housing 19, includes handle portion 16h and cocking arcuate upper arm piece 16p with its bifurcated right and left end prongs 24, 25, respectively. Lever 16 is connected to bolt 14 by toggle link 28. Cocking arcuate arm piece 16p carries hammer stop pin 29 which includes stem 29s and pin head 29h (see Fig. 12). Pin head 29h projects from the side of lever arcuate piece 16p (see Fig. 12). Hammer stop pin 29 functions to engage cam and hammer surface 17s in hammer recess 17r to rotate hammer 17 rearward to its full rearward position when lever 16 is swung down to unload firearm 10. Initially stop pin 29 engages hammer surface 17s to rotate hammer 17. As lever arm 16p (and its stop pin 29) travel further back, stop pin 29 leaves contact with hammer surface 17s and lower lever surface 161 of end prong 24 thereafter engages hammer surface 17s. Lower arm surface 161 follows an arc inscribed by radius RA about pin 13 (Figs. 5 and 6). Note that since Figs. 5 and 6 are right-hand side views, the body portion 17b of hammer 17 has been cut away to illustrate the hammer recess 17r and its cam surface 17s. In this embodiment, hammer 17 is rotated counterclockwise by combined action of pin 29 and lever end prong 24. Cocking lever 16 continues to move downwardly until hammer stop pin 29 engages housing stop surface 19e. During the downward movement of cocking lever 16, bolt 14, attached to lever 16 through link 28, is retracted along with the spent (or live) cartridge case.

Fig. 7 shows an alternative embodiment in which no hammer stop pin is employed. Instead, lever arm 16p' including right end prong 25 is made of a harder material permitting end prong 25 to repeatedly engage hammer surface 17s without excessive force to effect hammer rotation in the same manner as pin 29 and the end prong 24 performed in the prior embodiment. Finally, surface 16z of arm 16p engages housing stop 19e. Turning to Fig. 7a, connector pin 22 secures receiver 12 to housing 19. Lever end prong 24 extends downwardly a sufficient distance to engage stop 19e when lever 16 is fully opened with bolt 14 fully retracted.

During loading, cocking lever 16 is swung in the opposite direction upwardly to cause bolt 14 to capture a new cartridge for chambering. When cocking lever 16 reaches its full upward position at the end of its upward travel, bolt 14 is adjacent to and in contact with cartridge case C at point P (see Fig. 1). However, if cocking lever 21 does not fully complete its upward swing during loading but instead stops short of casing C in an intermediate position, leaving bolt 14 spaced from cartridge C, and when trigger 18 is thereafter pulled, the falling hammer 17 and its surface 17s engages hammer stop pin 29 and under urging of hammer spring 51 moves lever 16 (and connected bolt 14) forward against cartridge C. Such an intermediate position cannot be reached until hammer stop pin 29 has moved forward of hammer surface 17s. Movement from an intermediate position to a fire position is accomplished by hammer surface 17s engaging pin head 29h projecting from the side of lever 16. Pin 29 and its head 29h are located on arcuate arm prong 24 in such a position that as hammer 17 falls under the urging of spring 51 it causes lever 16 to move upwardly and forwardly until bolt 14 is locked against cartridge case C at point P. This action of the hammer 17 on head 29h of stop pin 29 assures that bolt 14 is in its closed proper ready-to-fire position prior to actual firing of firearm 10. Hammer 17 cannot strike firing

pin 15 (bolt 14) until lever 16 is a few thousandths of an inch from being fully closed (i.e., .040-0.50 inches).

Thus, lever 16 has a fully open position (Fig. 2) with pin 29 against housing stop surface 19e; a fully closed position (Fig. 1) in which bolt 14 is in full contact at point P against cartridge case C and lever 16 can also have a temporary less-than-fully-closed position in which bolt 14 is touching cartridge case C or spaced a short distance from case C. When bolt 14 is touching case C, but in its unlocked (down) position, or partial down position, striking of pin 29 by hammer 17 will then close the lever 16 fully locking bolt 14. In this position, lever 16 with its projecting pin head 29h (hammer 17) in its cocked position) is positioned forward of hammer surface 17s. Pin head 29h is engaged by hammer surface 17s during hammer 17's travel after being released by sear 52 thus moving lever 16 (and bolt 14) forward to assure bolt 14 is closed and locked prior to firing. In the fully open position of lever 16, the rear surface 14s of bolt 14 is slightly spaced from rear receiver wall 11w (Fig. 7) of receiver 12. This clearance, assured by hammer stop pin 29 contacting seat 19e, prevents strain on the forward ends 24, 25 of forward lever portion 16p of lever 16.

Turning to Figs. 8, 9 and 10, the system for resisting the unlocking of bolt 14 upon firing includes lever arm portion 16p with its forward end bifurcated right and left arm prongs 24, 25, respectively; the lever arm end pin 26; link 28 sandwiched between lever arm prongs 24, 25; and bolt cross pin 31. Bolt cross pin 31 is located in bolt lower portion 35. Elongated link slot 28s rides over arm pin 26. Movement toward a bolt lock position is attained when lever arm prongs 24, 25 are moved forward until the center 26c of arm end pin 26 is forward of line L as shown in Figs. 1, 4 and 8. Line L is the center line between center 31c of bolt cross pin 31 and the center 13c of stationary housing pin 13. During locking of the system, lever arm portion 16p with its

end prongs 24, 25 and connected link 28 are swung and oriented to positions where center line LL and line L become superimposed upon one another. Line LL is the line between pin center 31c and pin center 26c. During such movement toward locking, lever 16 continues its forward and upward movement until it reaches the fully locked position (Figs. 1, 4 and 8). In the lock position, tail 28t on link 28 engages pin 21 to limit arm portion 16p movement and at this point detent 45 snaps into position (Fig. 12). As bolt 14 is moved to the lock position, bolt 14 is urged upwardly causing bolt upper angled lock surface 14c to engage complementary receiver lock shoulder 9s which, due to such complementary angles of such surfaces, urges bolt 14 toward and against cartridge case C at surface area A. Bolt 14 travels forward until it meets case C at area A or when the chamber is empty it meets area A. When bolt 14 cannot move forward any further, and since lever portion 16p is still rotating forward, link 28 rotates around bolt pin 31 and lever pin 26. Further, since center 26c is a set distance from pin center 13c, rotation of link 28 causes pin 31 to rise and bolt 14 to pivot about point P through radius R resulting in its rearward end rising into its locking recess 12r and against surface 9s. There is clearance between surface A and bolt face 14f to permit such bolt 14 rotation about pivot point P Fig. 1).

Turning to Figs. 1 and 1a, bolt guide rails 40a, 40b ride in receiver grooves 41a, 41b and provide pivot point P, about which bolt 14 pivots during its locking movements. In the fully locked position, bolt lower portion surfaces 35a, 35b engage upper prong surfaces 24s, 25s (see Figs. 1, 8 and 10) which engagement assists in holding the system in its locked positions.

Upon firing, forces are created (including those from the expanding cartridge C against bolt face 14f) which forces cause bolt 14 to resist forward movement, remain stationary

or when the forces created by expanding gases are great enough bolt 14 will move slightly rearwardly and downwardly as bolt lock surface 14c and receiver lock surface 9s move relatively to one another. Such surface-to-surface relative motion, when it occurs, is reflected in the increased clearance between receiver rearward surface 12a and upper rearward bolt surface 14a which clearance Y varies as bolt 14 is locked and unlocked (Fig. 1). Clearance Y is smallest when pin centers 13c, 26c and 31c are all in a straight line (lines LL, L and LLL all superimposed). This alignment is the start of the over center-lock position. Once arm 16p including its prongs 24, 25 passes such pin center 31c, 26c and 31c alignment, arm 16p moves clockwise until fully locked (Fig. 2). Firing at any time during such movement from such pin center alignment to and including the fully locked position (Fig. 1) will result in movement of bolt 14 as described above, causing bolt pin 31 to move downwardly creating a toggle (over-center) arrangement which toggle lock is strengthened by such bolt pin movement. Firing forces acting on bolt 14 increase the strength of the bolt/lever lock. In this toggle (over-center) situation, an unlock force of substantial magnitude would be required to move cocking lever 16 (and its pin 26) rearwardly toward line L and beyond it (over-center).

At the moment of firing, it is important that bolt 14 remain securely closed in such fully seated lock position to protect the cartridge case C from rupturing due to the high pressure gases produced. When cartridge C is fired it produces a back thrust against the bolt face 14f which is transmitted from bolt surface 14c to recess surface 12s. Most of the force is transferred to receiver 12, but since 14c and 12s are angled to allow surface 14c to drop and unlock, a fractional down force is transmitted to triangles L, LL and LLL through centers 13c, 31c and 21c, as well as surfaces 24s, 25s, 35a, 35b (Figs. 1, 4 and 8), all to

increase the strength of the lock system as explained above.

To unlock the system after firing is complete, cocking lever 16, including its arm portion 16p, are moved in direction (D) (see Figs. 9 and 10) with little or no force except that to overcome detent 45 (see Figs. 7a and 12), the force to cock back hammer 17 and any friction in the system. As lever 16 is moved rearwardly, prongs enter bolt recess 14r to provide clearance (Fig. 10). The elongation of the link slot 28s allows lever portion 16p to rotate in direction D without pulling down bolt 14 until the lever prong surfaces 24s, 25s have cleared the bolt prong surfaces 35a, 35b.

Fig. 8a shows an alternative embodiment in which receiver 12 is made of steel obviating the need for a pin 9p. Recess surface 9s' engages bolt surface 14c'.

Finally, with reference to Fig. 12, in its locked position, cocking lever 16p is further secured by a spring loaded detent 45 which is mounted in housing 19 with a detent nose 45n engaged in a recess 16r of lever 16. Spring 45s urges nose 45n into recess 16r.

Receiver 12, lever 16 and lever housing 19 are preferably made of an aluminum alloy or other light material with pins 9, 29; and link 28, bolt 14 and pin 21 being made of steel or other hard material for strength and to reduce wear.

WE CLAIM:

1. In a lever action firearm having a frame, a cartridge chamber, a receiver, a bolt, a pivotal hammer, a cocking lever and a cross pin in the frame about which the cocking lever pivots to unload and load comprising

a) a configured hammer surface; and

b) hammer engaging means on the cocking lever positioned such that the hammer engaging means engages the hammer surface to rotate the hammer away from the cartridge chamber when the lever is cocked to unload.

2. The lever action firearm of claim 1 in which the hammer engaging means is a pin surface mounted on the cocking lever.

3. The lever action firearm of claim 1 in which the cocking lever includes a forward arcuate portion and the hammer engaging means is such arcuate portion.

4. The lever action firearm of claim 1 in which the hammer engaging means on the lever is engaged by the hammer surface during forward movement of the hammer to fire when the lever is not fully forward.

5. The lever action firearm of claim 1 having link means between the lever and the bolt to permit the bolt to be moved back and down by the lever and to be moved forward and up by the lever.

6. In a lever action firearm having a receiver, a bolt, a pivotal hammer, a cocking lever, and a cross pin about which the cocking lever pivots comprising

a) hammer surface means;

b) hammer engaging means positioned on the cocking lever such that cocking of the lever about its pivot rotates the hammer back;

c) a lock surface on the receiver and a complementary lock surface on the bolt;

d) a pin on the bolt and a pin on the cocking lever;

e) a link with one end mounted on the bolt pin and the other end mounted on the lever pin;

f) a center line between the bolt pin and the lever cross pivot pin; and

g) the link and lever being so configured such that the receiver lock surface and bolt lock surface engage under forces of firing to cause movement relative to one another to resist movement of the link and lever through such centerline from a position forward of such center line to a position rearward of such center line.

7. The firearm of claim 6 in which at the time of firing and for a short time thereafter the bolt lock surface and complementary receiver lock surface resist movement relative to one another as the forward end of the bolt is engaged by the cartridge which prevents the bolt pin on the bolt to move.

8. The firearm of claim 6 in which at the time of firing and for a short time thereafter the bolt lock surface and complementary receiver lock surface move relative to one another as the forward end of the bolt engages the cartridge which causes the bolt pin on the bolt to be positioned a

selected unlock distance from the lever cross pivot pin which distance requires a substantial force to unlock the bolt.

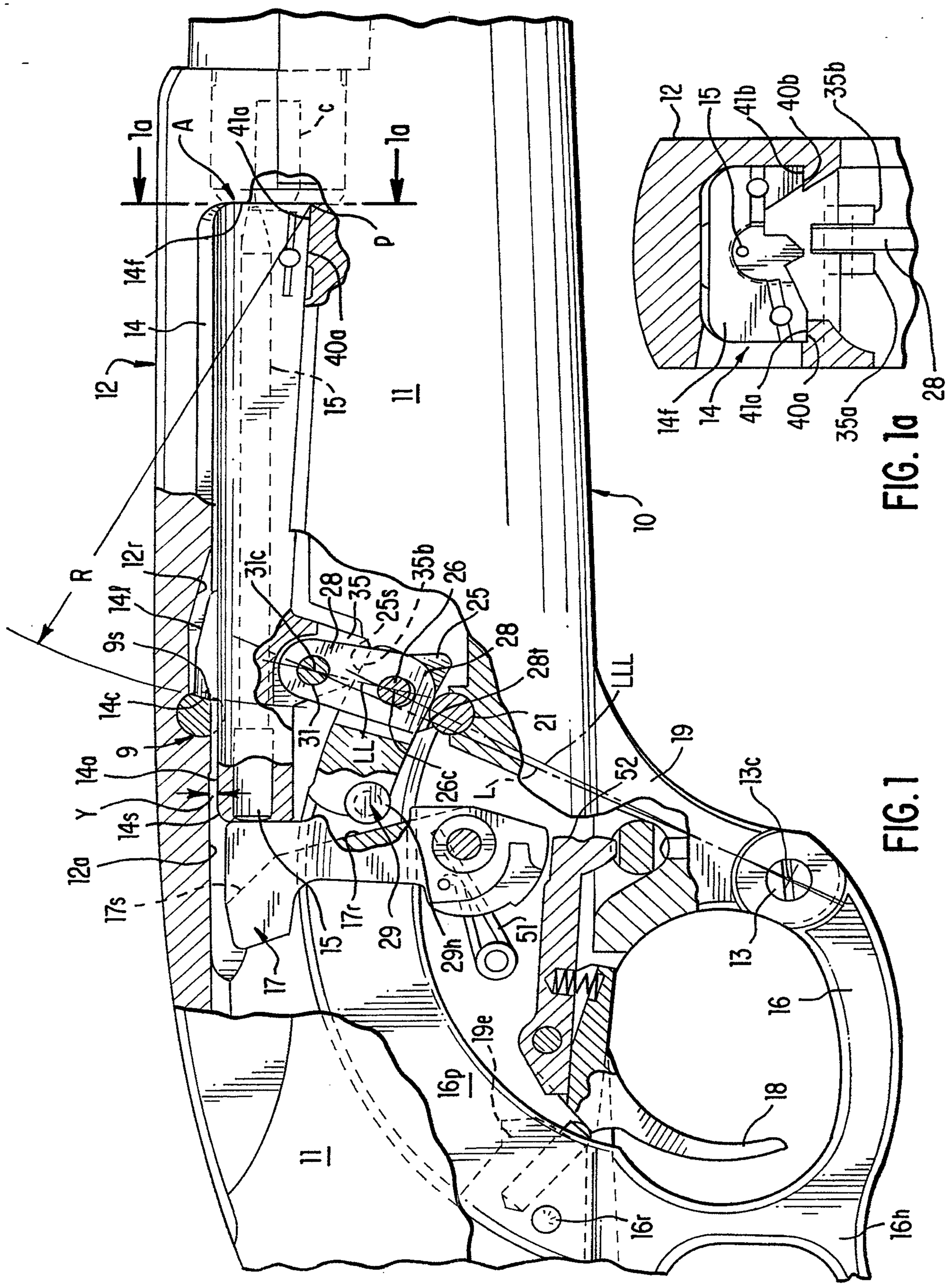
9. The firearm of claim 6 in which upon completion of firing, small forces to overcome (a) a detent, (b) hammer cocking and (c) friction may be applied to the cocking lever to unlock the lever and its connected bolt.

10. The firearm of claim 6 in which the receiver is made of a first material and the receiver cam surface is made of a second material which is harder than the first material.

11. The firearm of claim 9 in which the receiver is fabricated of a first material and has inserted therein a cross pin of a second material harder than the first material.

12. The firearm of claim 8 in which the receiver and firearm housing are connected by pin means.

13. The firearm of claim 6 having in addition an elongated slot in the link to receive the cocking lever pin.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C
1a
14f
14
12
40a
15
7
11
P
12r
R
31c
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26
25s
25
28
28t
9s
14f
14c
9
14a
Y
14s
12a
17s
31
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LLL
19
26c
L
52
13c
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15
17r
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29h
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16p
18
11
16r
16h
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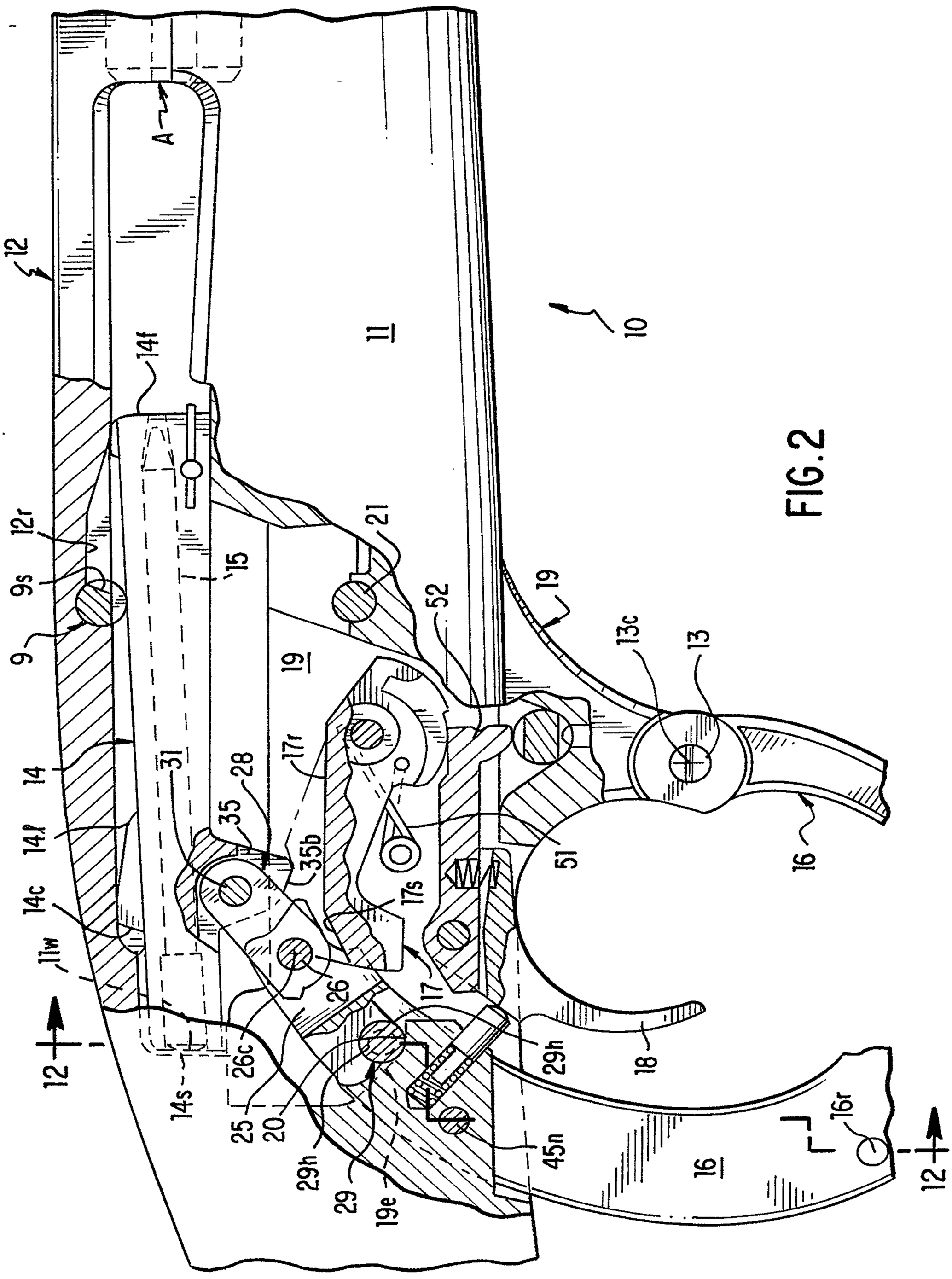
14f
14
41a
40a
35a
28
10

FIG. 1a

FIG. 1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21
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19
13c
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31
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35
35b
14c
17s
11w
51
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16
16r
12

FIG.2

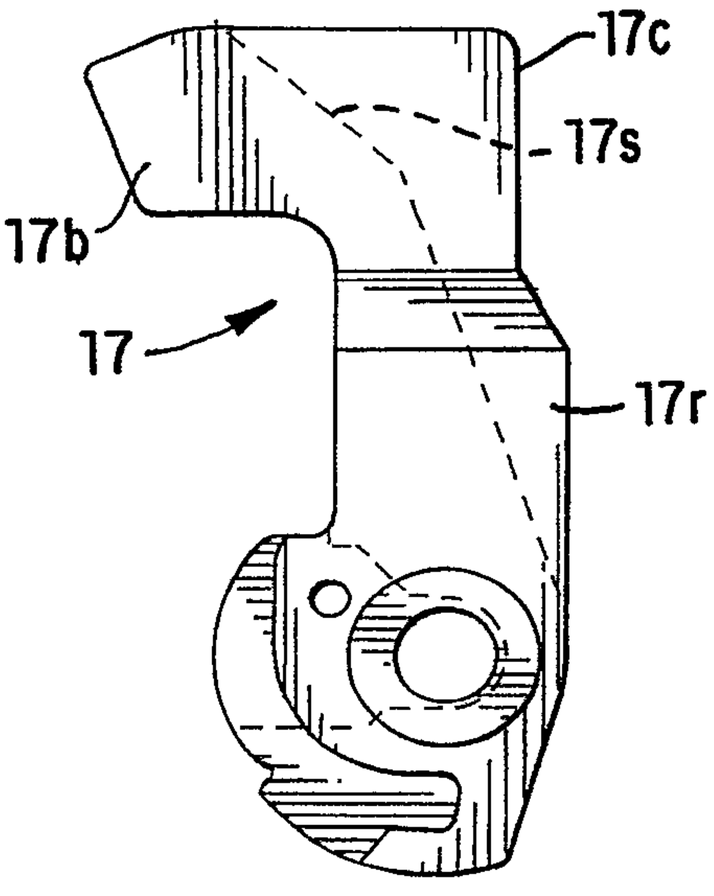


FIG. 3a

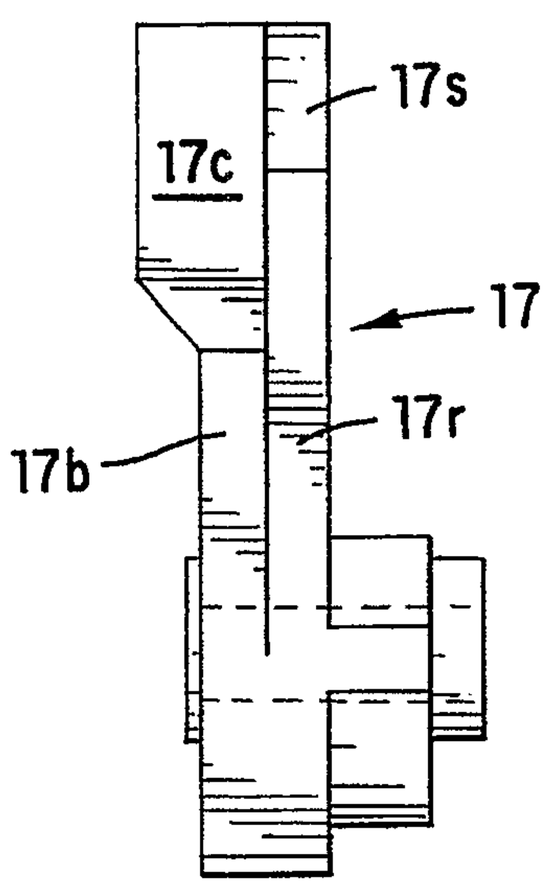


FIG. 3b

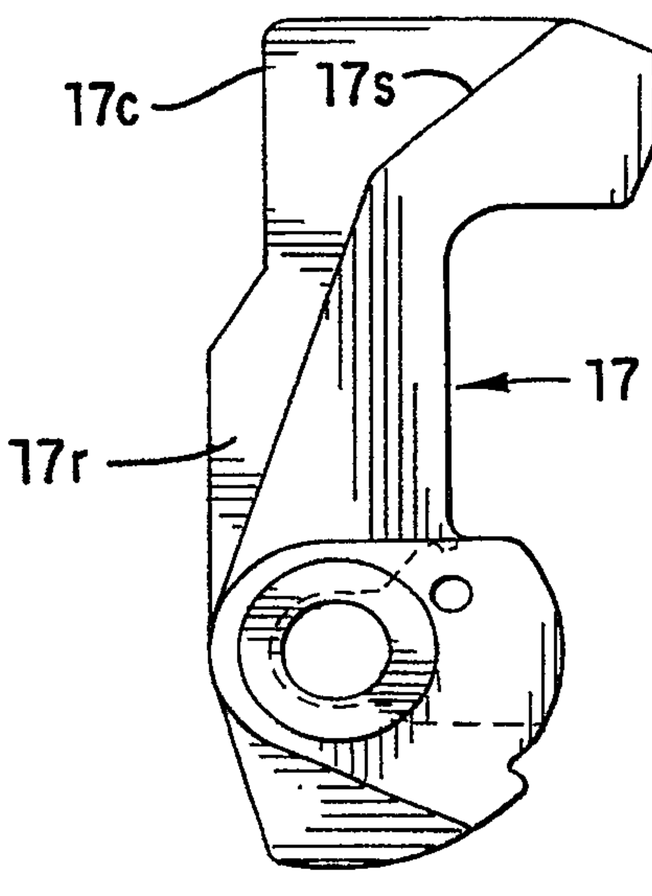


FIG. 3c

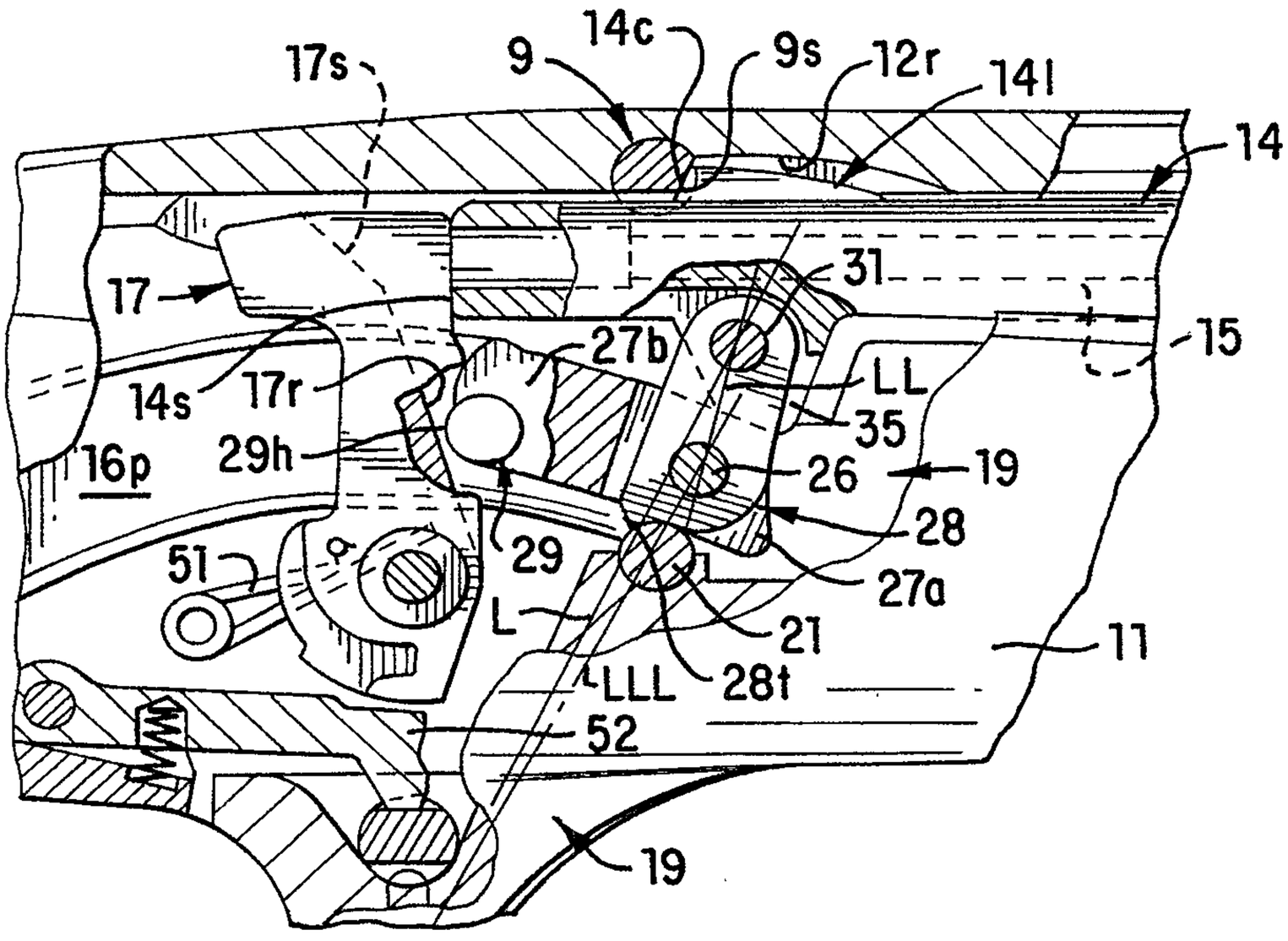
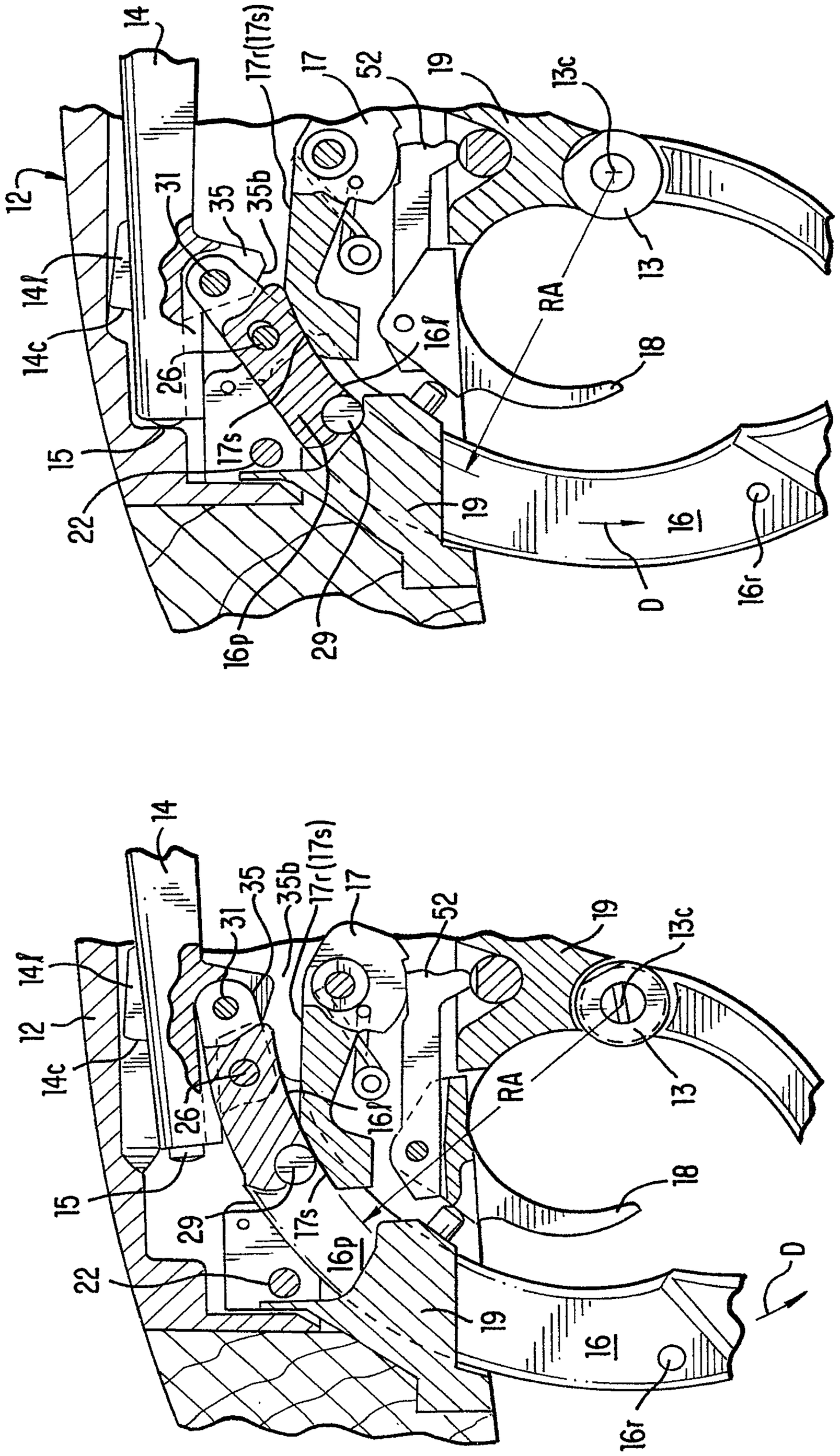


FIG. 4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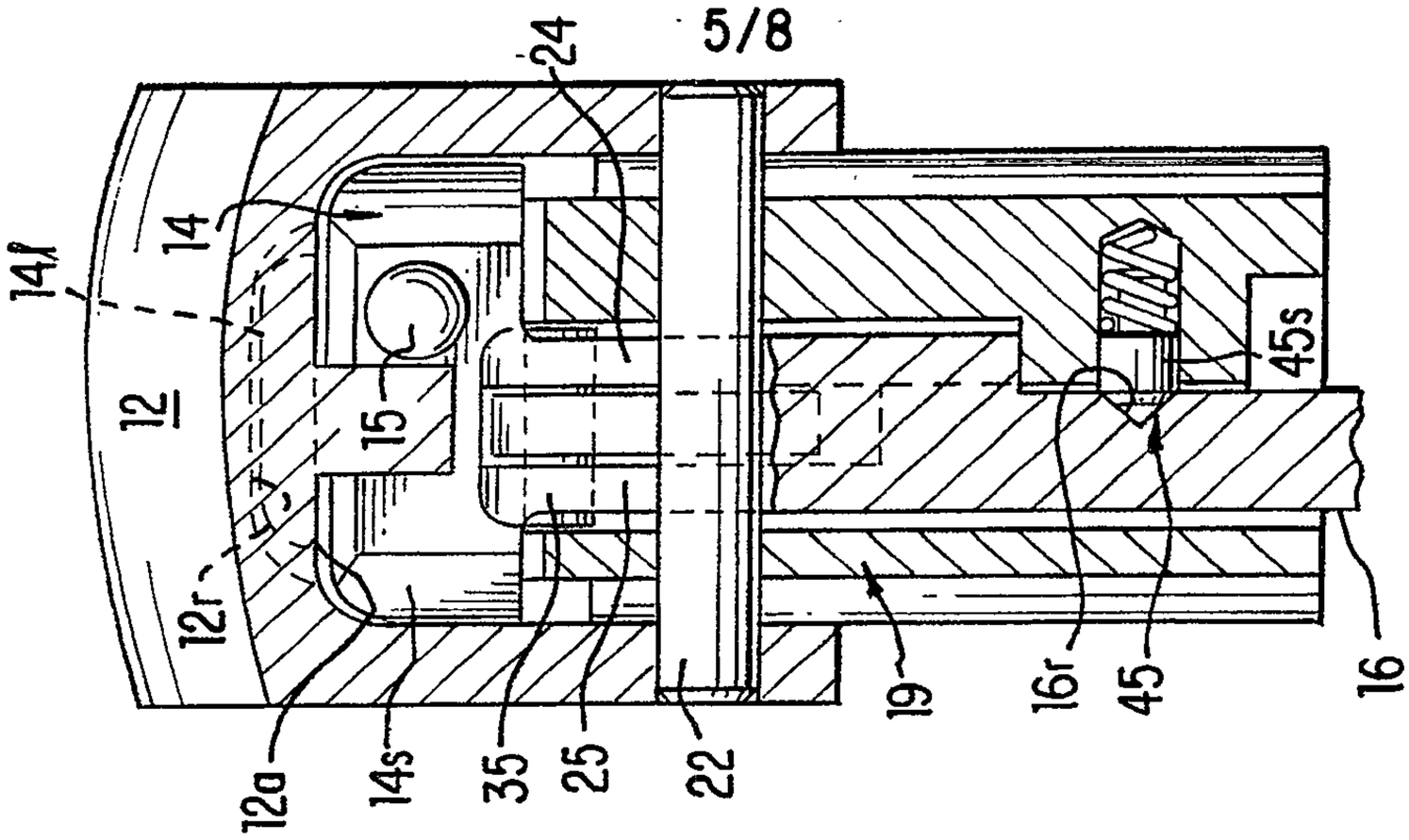
17r(17s)
17
52
19
13c
12
31
35
35b
14f
14c
26
15
17s
22
16p
29
16r
16
D
18
13
RA
A

FIG.6

FIG.5


24
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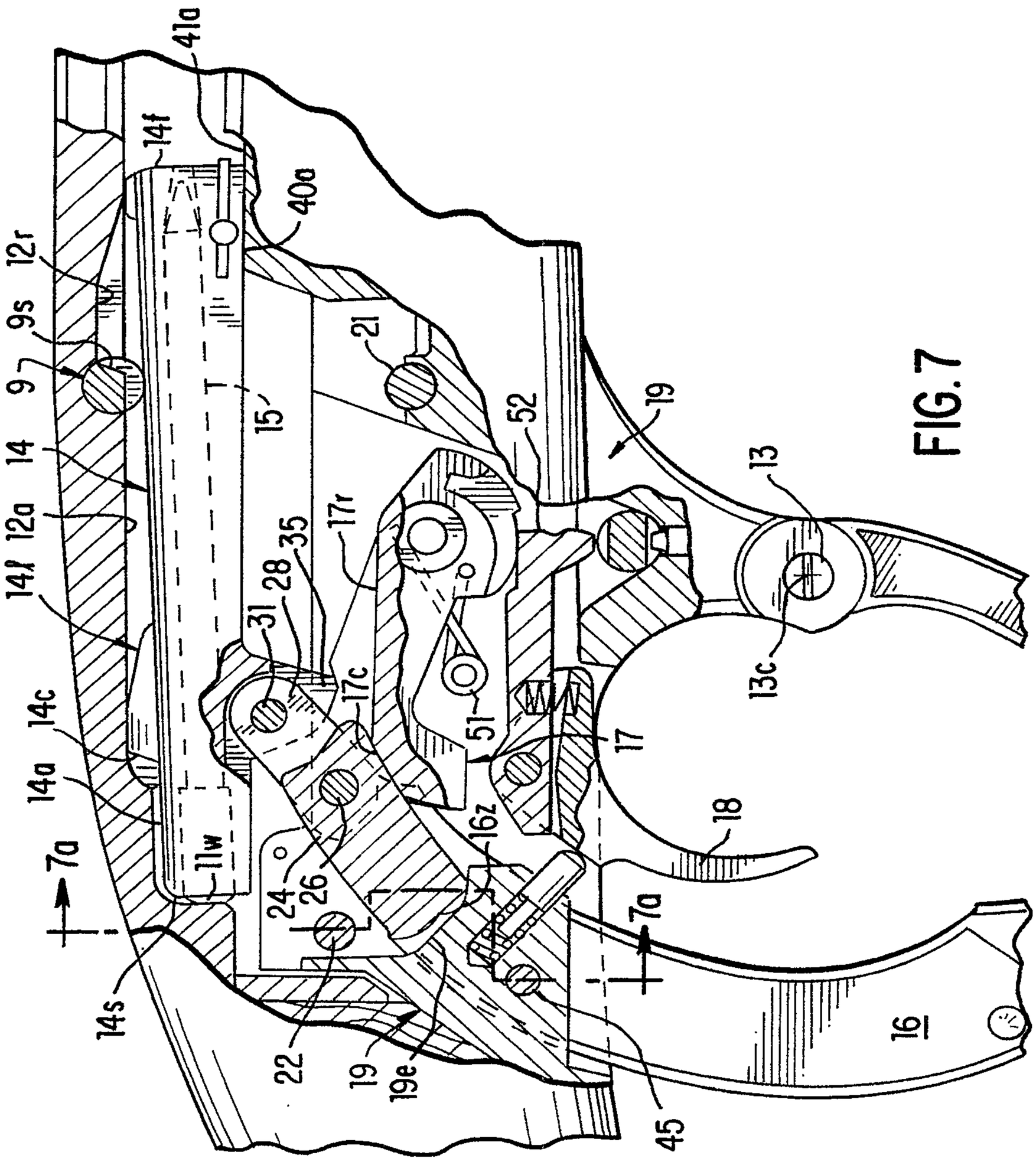
12a
14s
35
25
22
19
16r
45
16

FIG.7a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9s
9
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13
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35
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7a

FIG.7

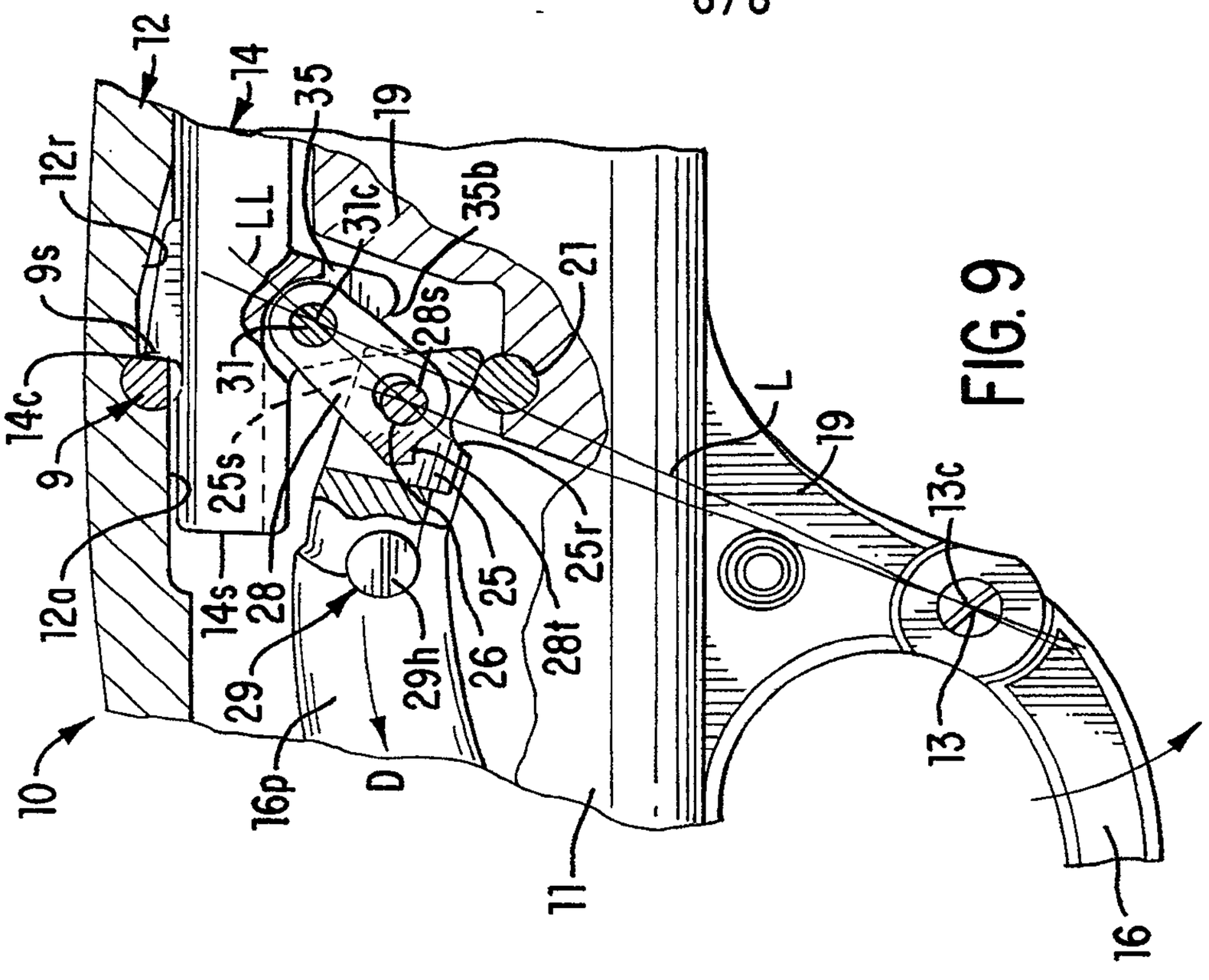


FIG. 9

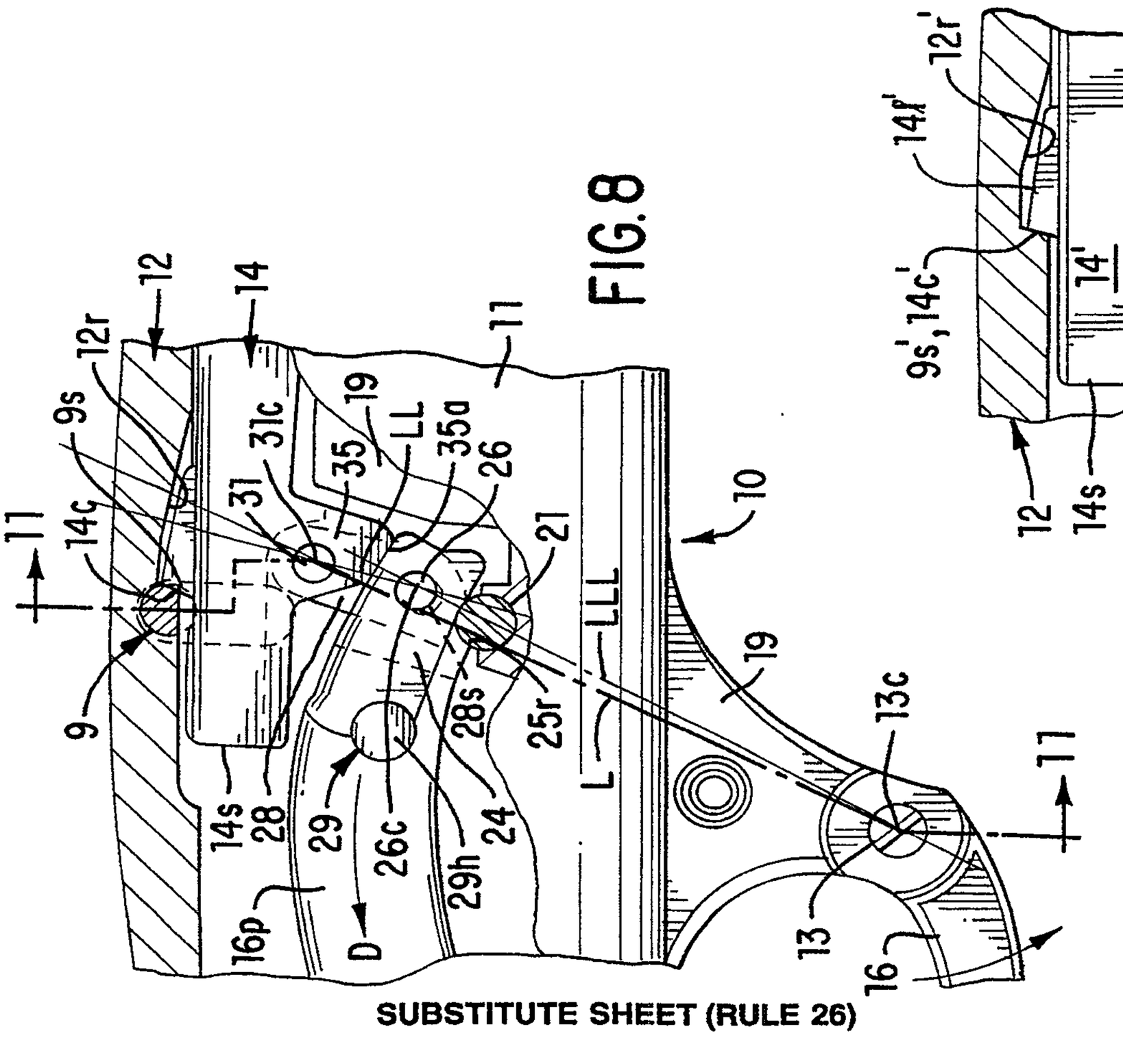


FIG.8

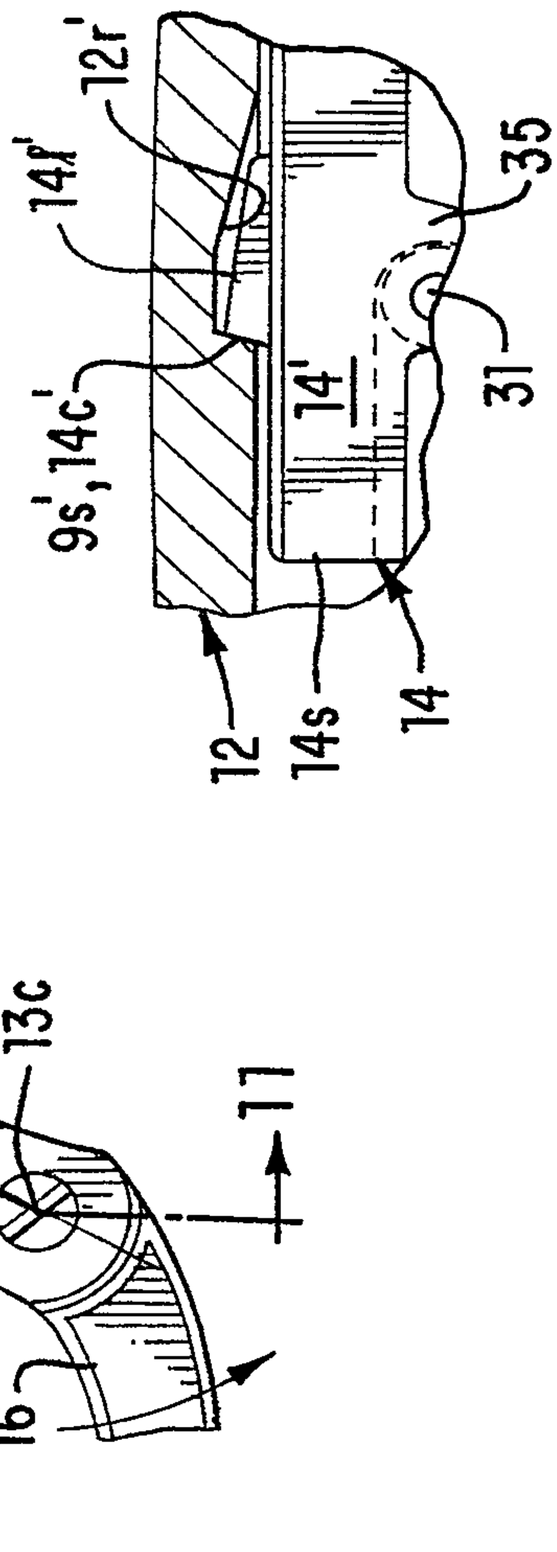


FIG.8a

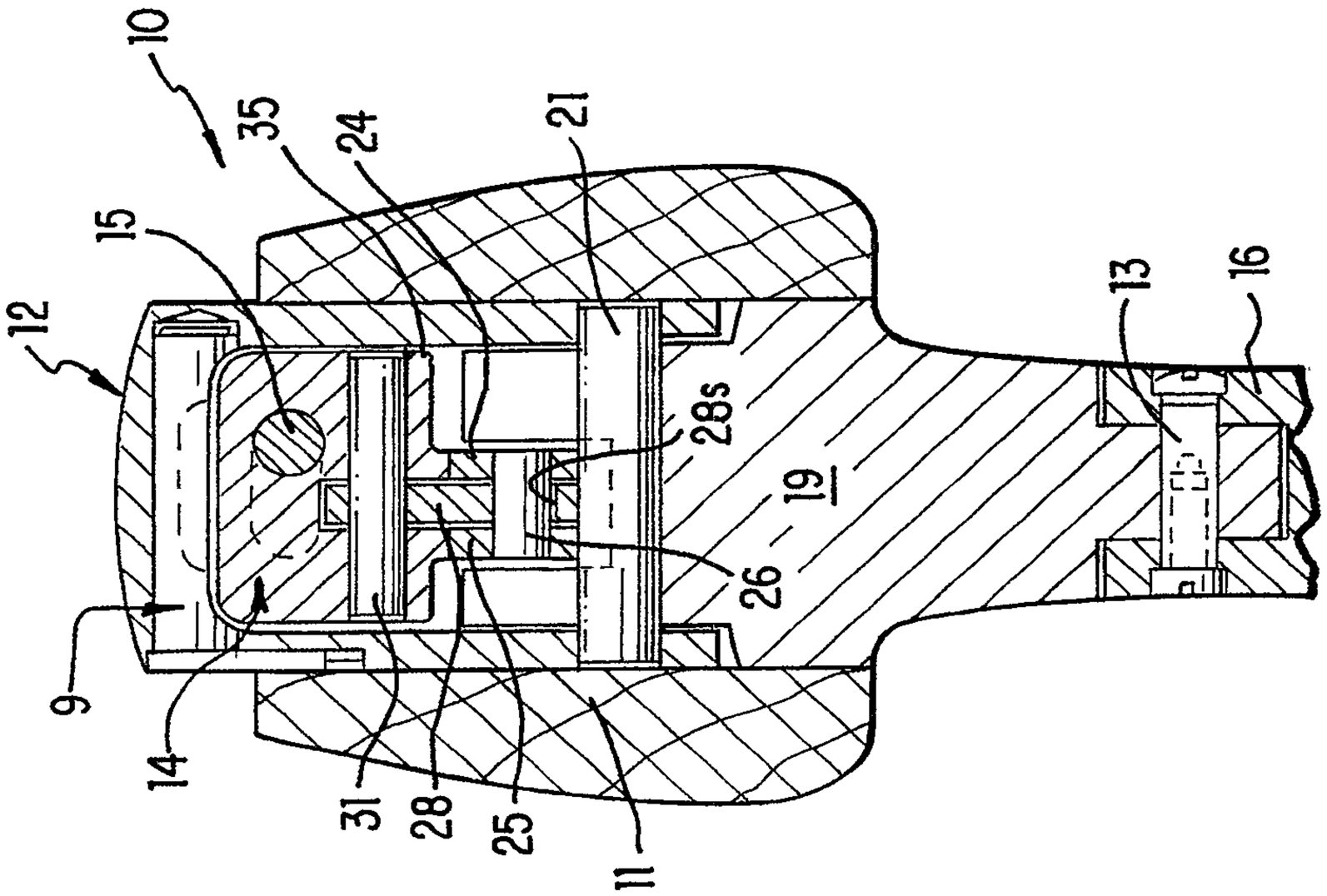

10
35
24
21
15
12
13
16
28s
19
26
9
14
31
28
25
11

FIG. 11

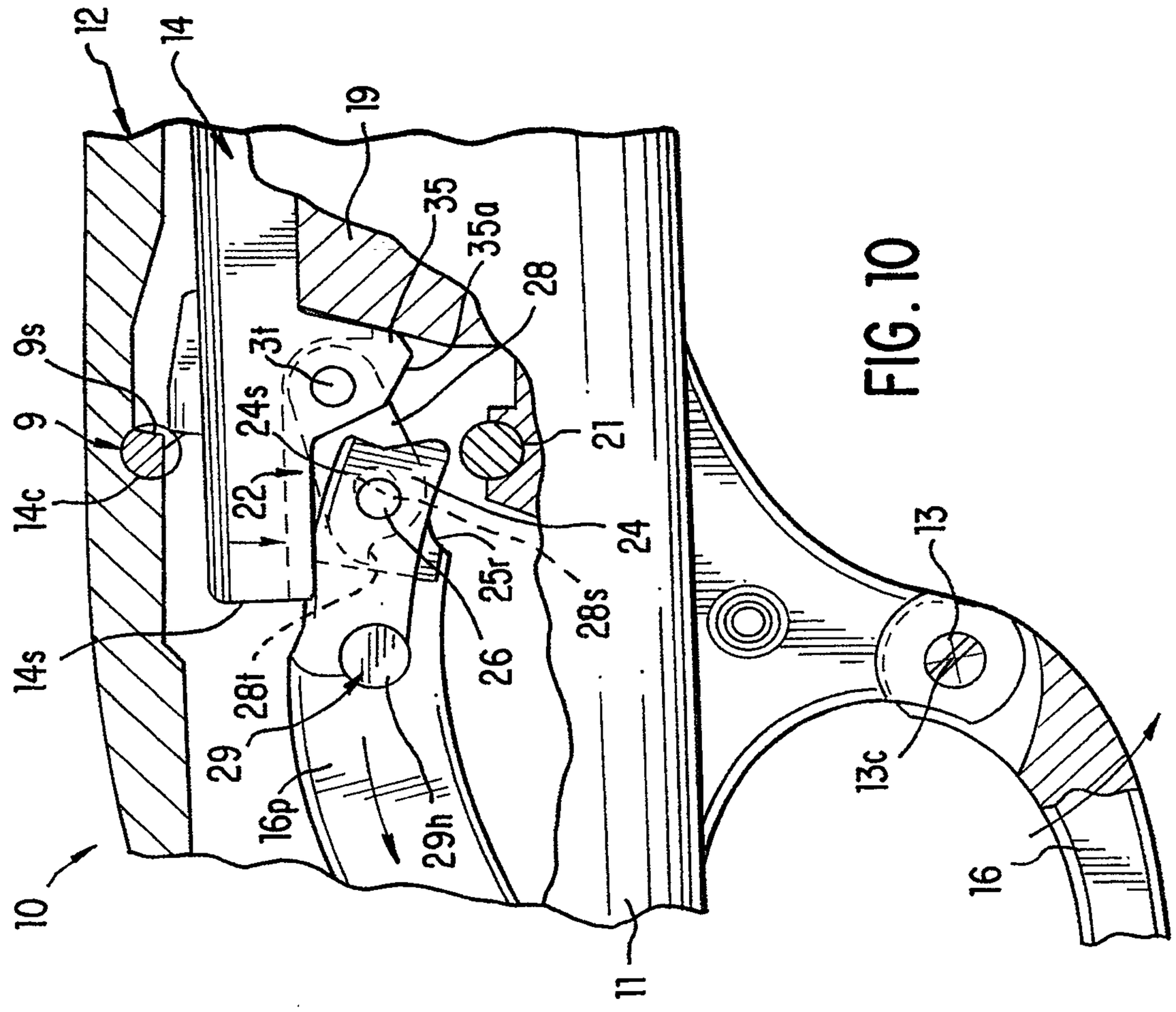

12
4
19
35
35a
28
9s
31
9
24s
21
14c
22
24
25r
14s
28t
28s
26
29
16p
29h
13
13c
16
10
11

FIG. 10

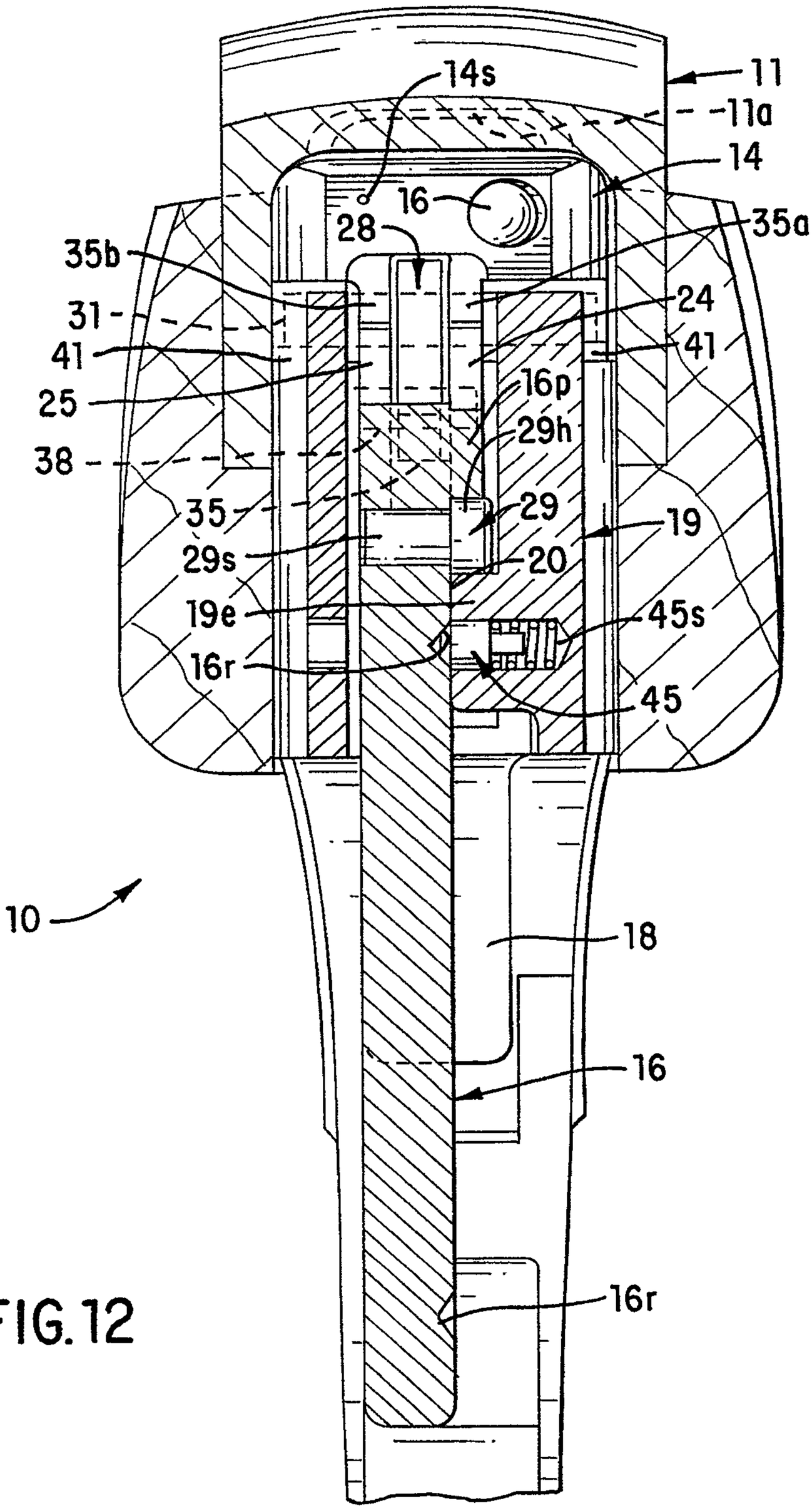
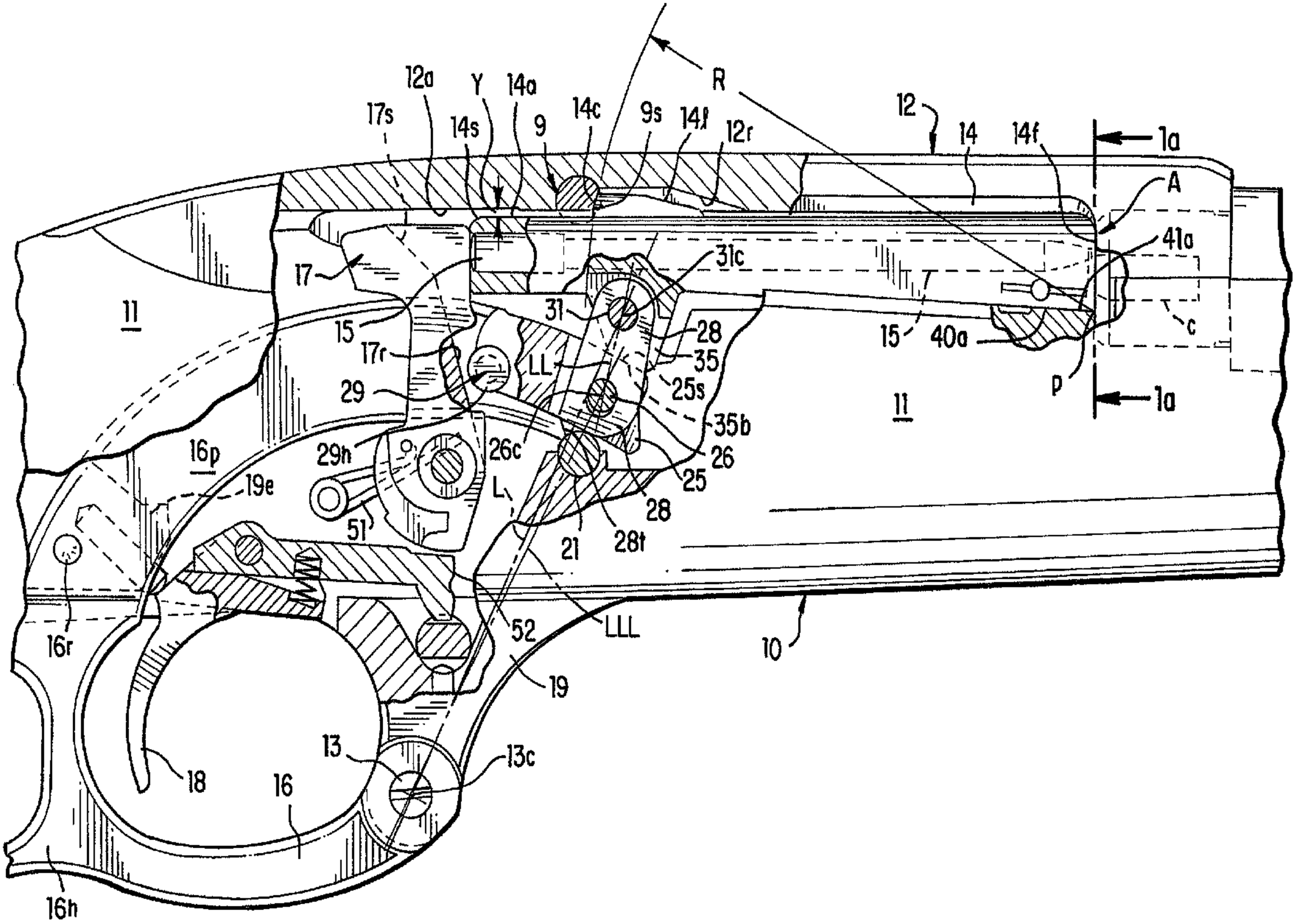

14s
11
11a
14
16
28
35a
35b
31
24
41
41
25
16p
29h
38
35
29
19
29s
20
19e
45s
16r
45
10
18
16
16r

FIG. 12


12a
Y
14a
R
17s
14s
9
14c
9s
14f
12r
12
14
14f
1a
A
41a
17
31c
11
31
28
15
17r
35
LL
29
25s
40a
c
P
1a
11
35b
16p
29h
9
26c
26
19e
L
25
28
51
21
28t
52
LLL
10
16r
19
13
13c
18
16
16h