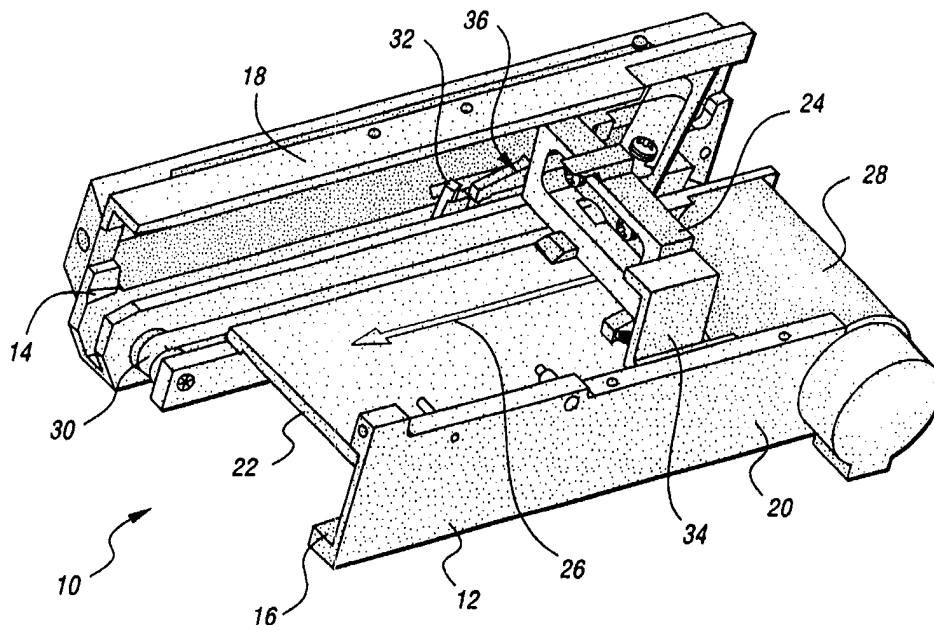




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: APPARATUS FOR HANDLING CARTRIDGES IN A STORAGE LIBRARY SYSTEM



(57) Abstract

An apparatus (10) for handling a cartridge (56) having a cartridge notch (54) formed therein in a storage library system includes a hand frame (12) adapted for receiving cartridges (56) and a reach system assembly (24) movable along the hand frame assembly (12). A latch arm assembly (36) is pivotally connected to the reach carriage assembly (42) and includes a latch tooth (52) thereon for selectively engaging the cartridge notch (54). The latch arm assembly (36) is pivotally movable between a first latching position for engagement in the notch, and a put position wherein the latch arm (36) is positioned for pushing the cartridge (56) out of the hand frame.

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APPARATUS FOR HANDLING CARTRIDGES IN A STORAGE LIBRARY SYSTEM

Technical Field

This invention relates to a hand for a storage
5 library system capable of grasping and manipulating
multiple storage media cartridges.

Background Of The Invention

Storage library systems are capable of storing
and rapidly retrieving large quantities of information
10 stored on storage media cartridges. Such storage
library systems often use robotic mechanisms to improve
the speed of information retrieval and the reliability
of maintaining the storage library cartridge inventory.
These robotic mechanisms typically comprise a hand
15 mechanism positioned on a movable arm. To retrieve
information, the robotic arm is moved to position the
hand near the inventory location of a desired media
cartridge. The hand is then activated to grip the
desired cartridge and remove it from the library
20 inventory location. The robotic arm with the hand
gripping the cartridge then moves to an appropriate
position to further process the cartridge. In this
manner, the robotic hand manipulates the cartridge for
access to information stored on the cartridge.

25 The hand typically comprises a gripper
mechanism for grasping the cartridge which includes
solenoid-operated opposing gripper plates which act
against a spring load. The spring load biases the
gripper plates to a closed position for grasping

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cartridges, and the solenoid is selectively actuated for opening the gripper plates against the spring force. One such device is described in U.S. Patent No. 5,418,664. Although these mechanisms work quite well, the solenoid introduces added weight to the hand assembly, and the electronics, software and hardware associated with running the gripper mechanism may be costly. The assembly also includes power cables which add weight to the assembly. Another disadvantage is the power consumption inherent in such a solenoid system.

It is desirable to provide a cartridge grasping assembly which does not require the solenoid mechanism and related electronics for opening and closing the gripper.

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Disclosure Of The Invention

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The present invention overcomes the above-referenced shortcomings of prior art assemblies by providing an apparatus for handling a cartridge in a storage library system which includes a mechanical latch arm assembly for grasping cartridges. The latch arm assembly is cam-actuated for pivoting between a "latching" position for engaging the cartridge, and a "put" position for pushing the cartridge out of the hand assembly.

25

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More specifically, the present invention provides an apparatus for handling a cartridge having a cartridge notch formed therein in a storage library system. The apparatus includes a hand frame adapted for receiving cartridges, and a reach carriage assembly movable along the hand frame assembly. A latch arm assembly is pivotally connected to the reach carriage

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assembly and includes a latch tooth thereon for selectively engaging the cartridge notch. The latch arm is pivotally movable between a latching position, wherein the tooth is positioned for engagement in the notch, and a put position wherein the latch arm is positioned for pushing the cartridge out of the hand frame.

Accordingly, an object of the present invention is to provide an apparatus for handling a cartridge in a storage library system in which the grasping mechanism of the hand is operated mechanically, rather than electrically, thereby eliminating the prior art solenoid.

The above object and other objects, features and advantages of the present invention are readily apparent from the following detailed description of the best mode for carrying out the invention when taken in connection with the accompanying drawings.

Brief Description Of The Drawings

FIGURE 1 shows a perspective view of a hand assembly in accordance with the present invention;

FIGURE 2 shows a perspective view of a reach carriage assembly in accordance with the present invention;

FIGURE 3 shows a cutaway perspective view of the reach carriage assembly of Figure 2;

FIGURE 4 shows a reverse cutaway perspective view of the reach carriage assembly of Figure 3;

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FIGURE 5 shows a perspective view of a reach carriage assembly grasping a cartridge in the "latched" position;

5 FIGURE 6 shows a perspective view of a reach carriage assembly engaging a cartridge in the "put" position;

FIGURE 7 shows a side view of a hand frame assembly with the latch assembly in the "get" position;

10 FIGURE 8 shows a side view of a hand frame assembly with the latch assembly in the "put" position;

FIGURE 9 shows a cutaway perspective view of a reach carriage and latch assembly, with the latch assembly moving toward the first cam member;

15 FIGURE 10 shows a cutaway perspective view of the reach carriage and latch assembly as shown in Figure 9, with the latch assembly engaging the first cam member;

20 FIGURE 11 shows a cutaway perspective view of the reach carriage and latch assembly, with the latch assembly being pivoted by the first cam member;

FIGURE 12 shows a cutaway perspective view of the reach carriage and latch assembly, with the latch assembly having been pivoted to the latching position by the first cam member;

25 FIGURE 13 shows a cutaway perspective view of a reach carriage assembly and cam block, with the latch assembly in the latching position;

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FIGURE 14 shows a cutaway perspective view of a reach carriage assembly and cam block, with the latch assembly engaging the cam block; and

5 FIGURE 15 shows a cutaway perspective view of a reach carriage assembly, with the latch assembly having been pivoted to the "put" position by the cam block.

Detailed Description Of The Best Mode For Carrying Out The Invention

10 A hand apparatus 10 for handling a cartridge in a storage library system is shown in Figure 1. The apparatus 10 includes a hand frame 12 adapted for receiving cartridges. The hand frame 12 includes tape cartridge lead-in features 14, 16, and opposing rails
15 18, 20 supported by a base 22 for capturing a cartridge.

The apparatus 10 also includes a reach carriage assembly 24 which is movable along the hand frame 12 in the direction shown by arrow 26, and in the opposing direction. A motor 28 is provided for moving
20 the reach carriage assembly 24 by means of the timing belt/pulley 30.

A first cam member 32 and cam block 34 are mounted to the hand frame 12 for pivoting the latch assembly 36 as the reach carriage assembly 24 is moved
25 back and forth along the hand frame 12.

Turning to Figure 2, the reach carriage assembly 24 comprises a linear bearing block 25 which carries the carriage face block 38. The carriage face block 38 includes fixed fingers 40, 42, and includes an

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aperture formed therethrough (not shown) for pivotally supporting the latch assembly 36.

The latch assembly 36 comprises a substantially L-shaped latch member 44, which includes first and second arms 46, 48, respectively. The latch assembly 36 also includes a rod (not shown) which extends through the aperture in the carriage face block 38 and connects to the third arm 50 at the opposing end of the carriage face block 38. The first arm 46 includes a tooth 52 thereon for selective engagement within the notch 54 in the cartridge 56, as shown in Figure 5. The carriage face block 38 also includes first and second stop pins 58, 60, as shown in Figure 3. The stop pins 58, 60 are adapted to engage the first and second arms 46, 48 for preventing pivotal movement of the latch assembly 36 beyond the put position or the latching position. The latch assembly 36 is rotatable 102° between the stop pins 58, 60.

The carriage face block 38 further includes a spring pin 62 extending therefrom for supporting an overcenter spring 64, which is connected at its opposing end to the third arm 50. The overcenter spring 64 holds the latch assembly 36 in the respective put position or pushing position.

Figures 3 and 4 show the latching assembly in the put position with the arms 48, 50 positioned for pushing the carriage out of the hand assembly.

As shown in Figure 5, the reach carriage assembly 24 may grasp and manipulate the cartridge 56 when the tooth 52 of the arm 46 is engaged within the notch 54 of the cartridge 56. As shown in Figure 6,

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with the arms 48, 50 in the put position, the arms 48, 50 are positioned to push against the cartridge 56 for pushing the cartridge 56 out of the hand frame 12.

5 Figure 7 shows a side view of the apparatus 10 with the latch assembly 36 in the latching or "get" position for advancing forward to grasp a cartridge. Figure 8 shows a side view of the apparatus 10 with the latch arm assembly 36 in the push position for pushing the cartridge out of the hand frame 12.

10 Figures 9-12 illustrate sequential steps for resetting the latch arm assembly 36 to the latching position or "get" position. In Figure 9, the reach carriage assembly 24 moves away from the cartridge cell toward the first cam member 32. The second arm 48
15 includes a second cam member 66 which is engageable with the first cam member 32 for pivoting the latch arm assembly 36. Figure 10 shows the second cam member 66 engaging the first cam member 32 as the reach carriage assembly 24 continues to move. Figure 11 shows the
20 first cam member 32 engaging the second cam member 66 for causing rotation of the latching mechanism 36. Figure 12 shows the latch arm assembly 36 rotated against the first stop pin 58 so that the latch arm assembly 36 is in the latching position. The spring 64
25 (see Figure 4) on the opposing end of the carriage face block holds the latch arm assembly 36 in the latching position against the first stop pin 58. The linear reach motion stops at this point.

30 The first cam member 32 is connected to a flexible flat spring component 33, so that the first cam member 32 will flex away from the second cam member 66 as it moves up the ramp 68 on the opposing side of the

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second cam member 66 when the reach carriage assembly 24 is moved toward a cartridge with the latch assembly 36 in the put position. Accordingly, as a result of this flexibility, the first cam member 32 does not interfere with such movement.

Figures 13-15 illustrate sequential steps for resetting the latch arm assembly 36 to the put position. Figure 13 shows the reach carriage assembly 24 moving away from the cartridge cell (not shown) toward the cam block 34, which is fixed to the base 22. The cam block 34 includes a cam surface 70 which is engageable with the third arm 50 of the latch assembly 36 for pivoting the latch assembly 36 to the put position. Figure 14 shows the third arm 50 making initial contact with the cam surface 70 of the cam block 34, and Figure 15 shows the third arm 50 moved to the put position by the cam surface 70 of the cam block 34 acting in concert with the overcenter spring 64.

Accordingly, with this configuration, the latch arm assembly 36 may be easily pivoted between the put position and latching position for selectively engaging cartridges or pushing cartridges out of the hand frame 12. Therefore, the solenoid, cables, electronics and associated software and hardware of the prior art systems are all eliminated with the present invention.

While the best mode for carrying out the invention has been described in detail, those familiar with the art in which this invention relates will recognize various alternative designs and embodiments for practicing the invention within the scope of the appended claims.

What Is Claimed Is:

1. An apparatus for handling a cartridge having a cartridge notch formed therein in a storage library system, comprising:

5 a hand frame adapted for receiving cartridges;
a reach carriage assembly movable along said hand frame assembly; and

10 a latch arm assembly pivotally connected to said reach carriage assembly and having a latch tooth thereon for selectively engaging the cartridge notch, wherein the latch arm assembly is pivotally movable between a latching position in which the tooth is positioned for engagement in the notch, and a put position in which the latch arm assembly is positioned
15 for pushing the cartridge out of the hand frame.

2. The apparatus of claim 1, wherein said latch arm assembly comprises a substantially L-shaped latch member having first and second arms, said first arm comprising said tooth, and said second arm adapted
20 for pushing the cartridge when the latch arm assembly is in the put position.

3. The apparatus of claim 2, wherein said reach carriage assembly comprises a carriage face block having an aperture formed therethrough, and said latch
25 arm assembly further comprises a third arm and a rod extending through said aperture, said rod having a first end connected to said latch member and a second end connected to said third arm.

4. The apparatus of claim 3, further
30 comprising:

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a first cam member extending from the hand frame; and

a second cam member extending from the second arm for selective engagement with said first cam member for engaging and pivoting the latch arm assembly from the put position to the latching position when the carriage assembly is moved in a first direction.

5. The apparatus of claim 4, wherein the second cam member comprises a ramp surface and the first cam member comprises a flexible material to facilitate bending movement over said ramp surface when the carriage is moved in a second direction opposite the first direction.

6. The apparatus of claim 5, further comprising:

a spring pin extending from said carriage face block;

an over-center spring extending between said spring pin and said third arm for holding the latch arm assembly in position; and

a cam block secured to the hand frame and engageable with said third arm for pivoting the latch arm assembly from the latching position to the put position.

7. The apparatus of claim 6, further comprising first and second stop pins extending from the carriage face block for stopping pivotal movement of the substantially L-shaped latch member in the latching position and put position, respectively.

8. An apparatus for grasping a cartridge having a cartridge notch formed therein in a storage

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library system including a hand frame adapted for receiving such cartridge and a reach carriage assembly including a carriage face block movable along the hand frame assembly, the apparatus comprising:

5 a latch arm assembly connected to the reach carriage assembly and having a latch tooth thereon for selectively engaging the cartridge notch, wherein the latch arm assembly is pivotally movable between a latching position in which the tooth is positioned for
10 engagement in the notch, and a put position in which the latch arm assembly is positioned for pushing the cartridge out of the hand frame.

9. The apparatus of claim 8, wherein said latch arm assembly comprises a substantially L-shaped
15 latch member having first and second arms, said first arm comprising said tooth, and said second arm adapted for pushing the cartridge when the latch arm assembly is in the put position.

10. The apparatus of claim 9, wherein said
20 latch arm assembly further comprises a third arm and a rod extending through the carriage face block, said rod having a first end connected to said latch member and a second end connected to said third arm.

11. The apparatus of claim 10, further
25 comprising:

 a first cam member extending from the hand frame; and

 a second cam member extending from the second arm for selective engagement with said first cam member
30 for engaging and pivoting the latch arm assembly from the put position to the latching position when the carriage assembly is moved in a first direction.

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12. The apparatus of claim 11, wherein the second cam member comprises a ramp surface and the first cam member comprises a flexible material to facilitate bending movement over said ramp surface when the carriage is moved in a second direction opposite the first direction.

13. The apparatus of claim 12, further comprising:

a spring pin extending from the carriage face block;

an over-center spring extending between said spring pin and said third arm for holding the latch arm assembly in position; and

a cam block secured to the hand frame and engageable with said third arm for pivoting the latch arm assembly from the latching position to the put position.

14. The apparatus of claim 13, further comprising first and second stop pins extending from the carriage face block for stopping pivotal movement of the substantially L-shaped latch member in the latching position and put position, respectively.

15. An apparatus for handling a cartridge having a cartridge notch formed therein in a storage library system, comprising:

a hand frame adapted for receiving cartridges, with a first cam member extending from the hand frame and a cam block secured to the hand frame;

a reach carriage assembly movable along said hand frame assembly; and

a latch arm assembly pivotally connected to said reach carriage assembly and having a latch tooth

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thereon for selectively engaging the cartridge notch, wherein the latch arm assembly is pivotally movable between a latching position in which the tooth is positioned for engagement in the notch, and a put
5 position in which the latch arm assembly is positioned for pushing the cartridge out of the hand frame, said first cam member being engageable with the latch arm assembly for pivoting the latch arm assembly from the put position to the latching position, and said cam
10 block being engageable with the latch arm assembly for causing pivotal movement of the latch arm assembly from the latching position to the put position.

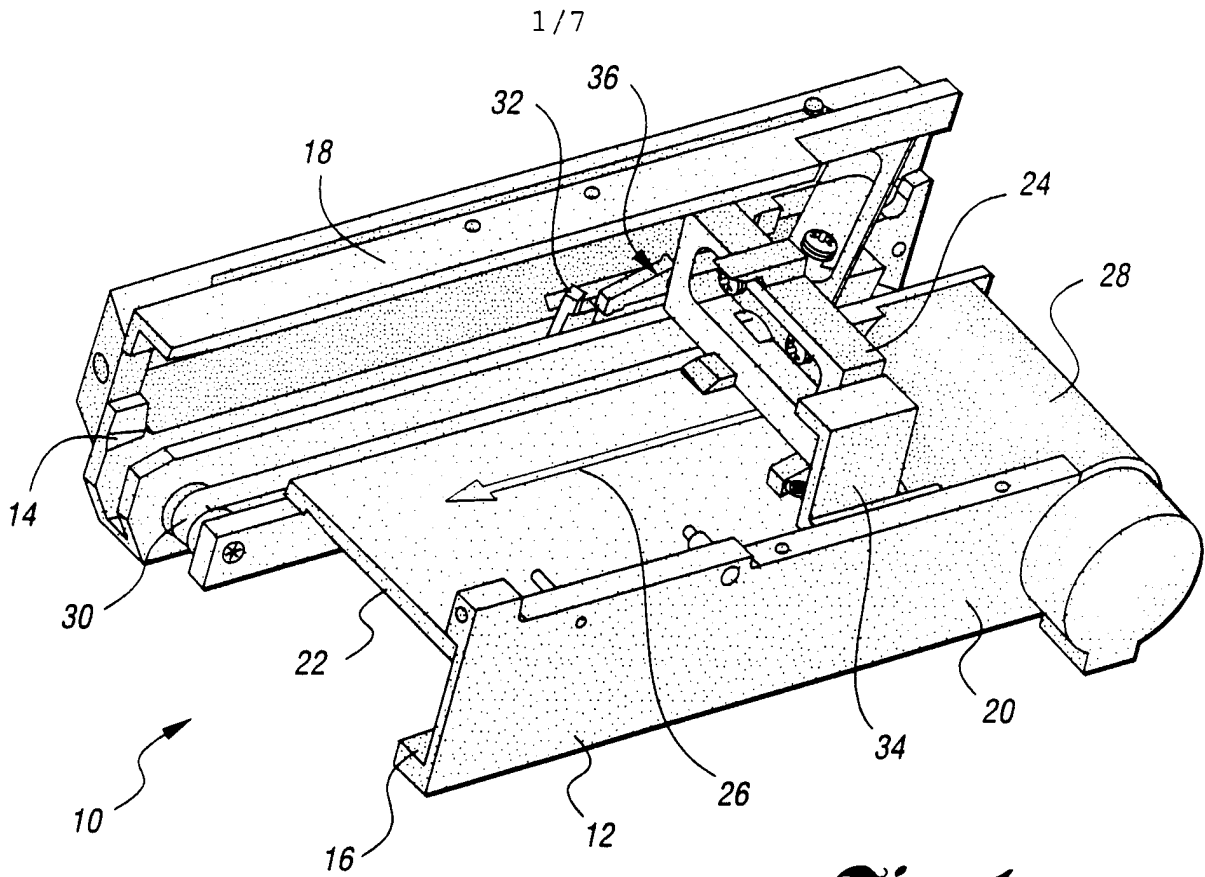


Fig. 1

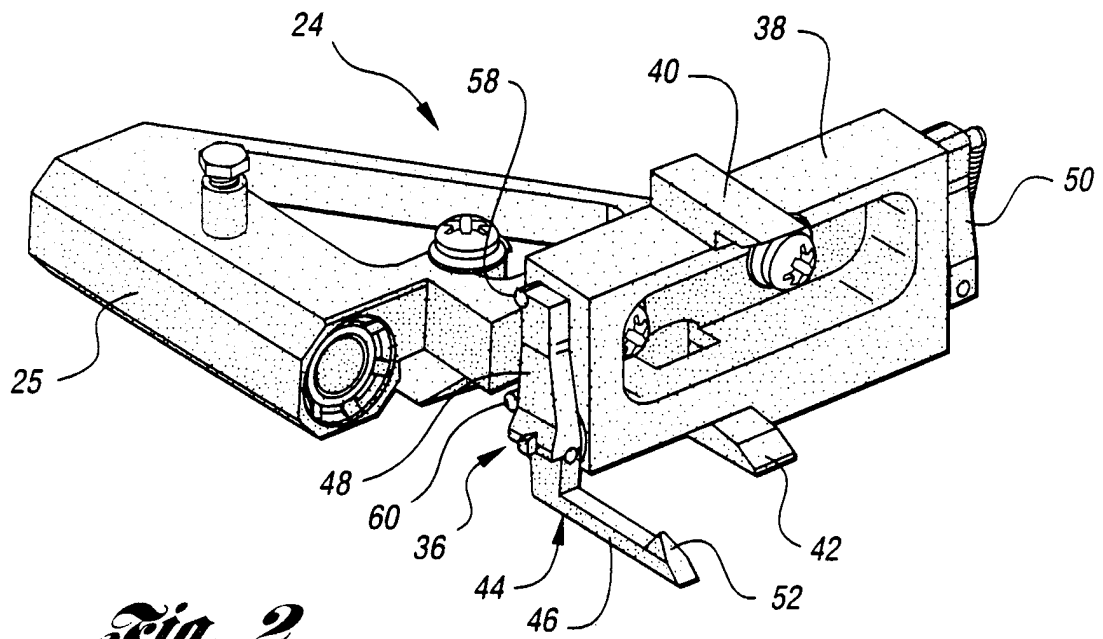


Fig. 2

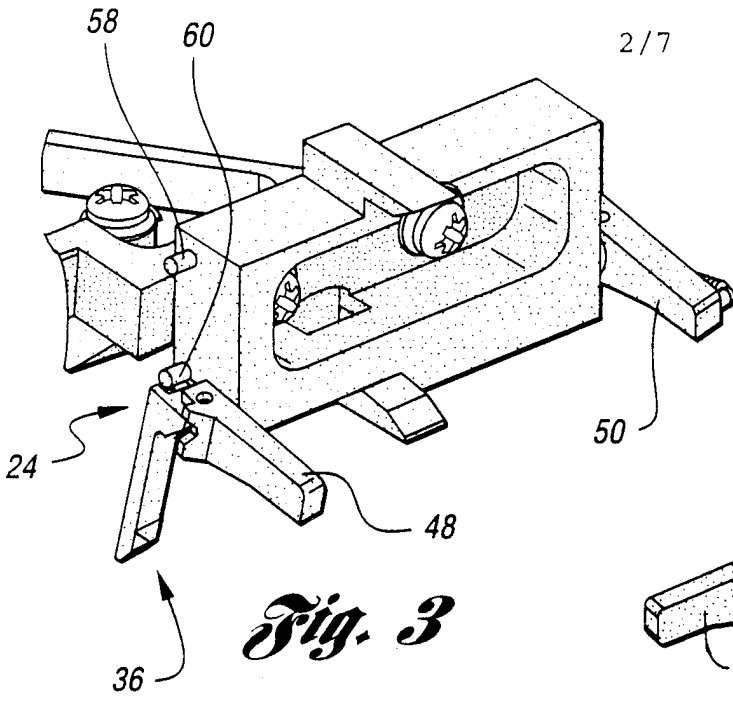


Fig. 3

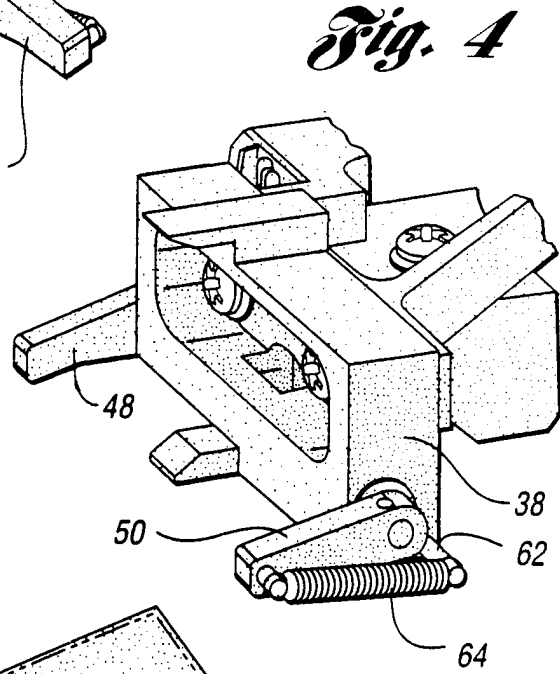


Fig. 4

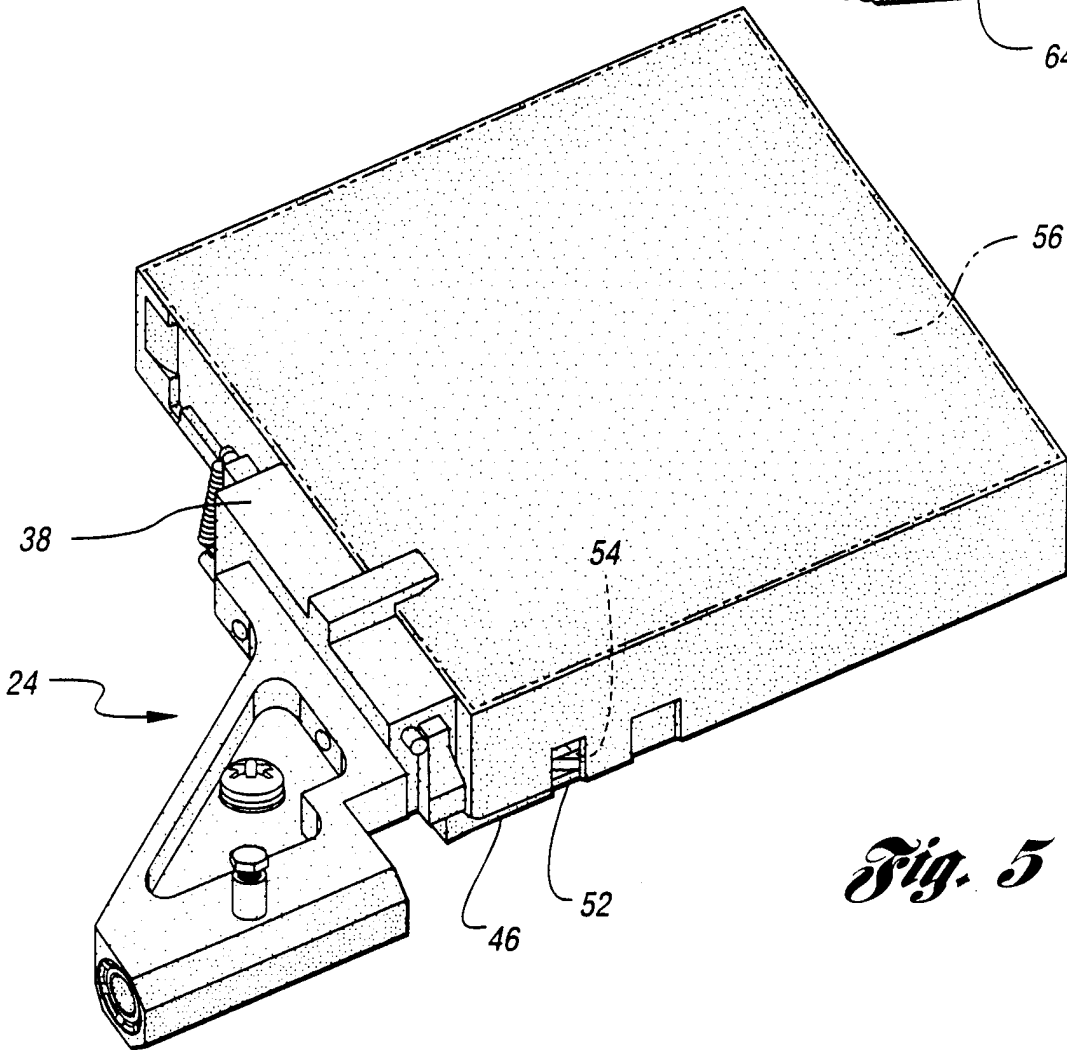


Fig. 5

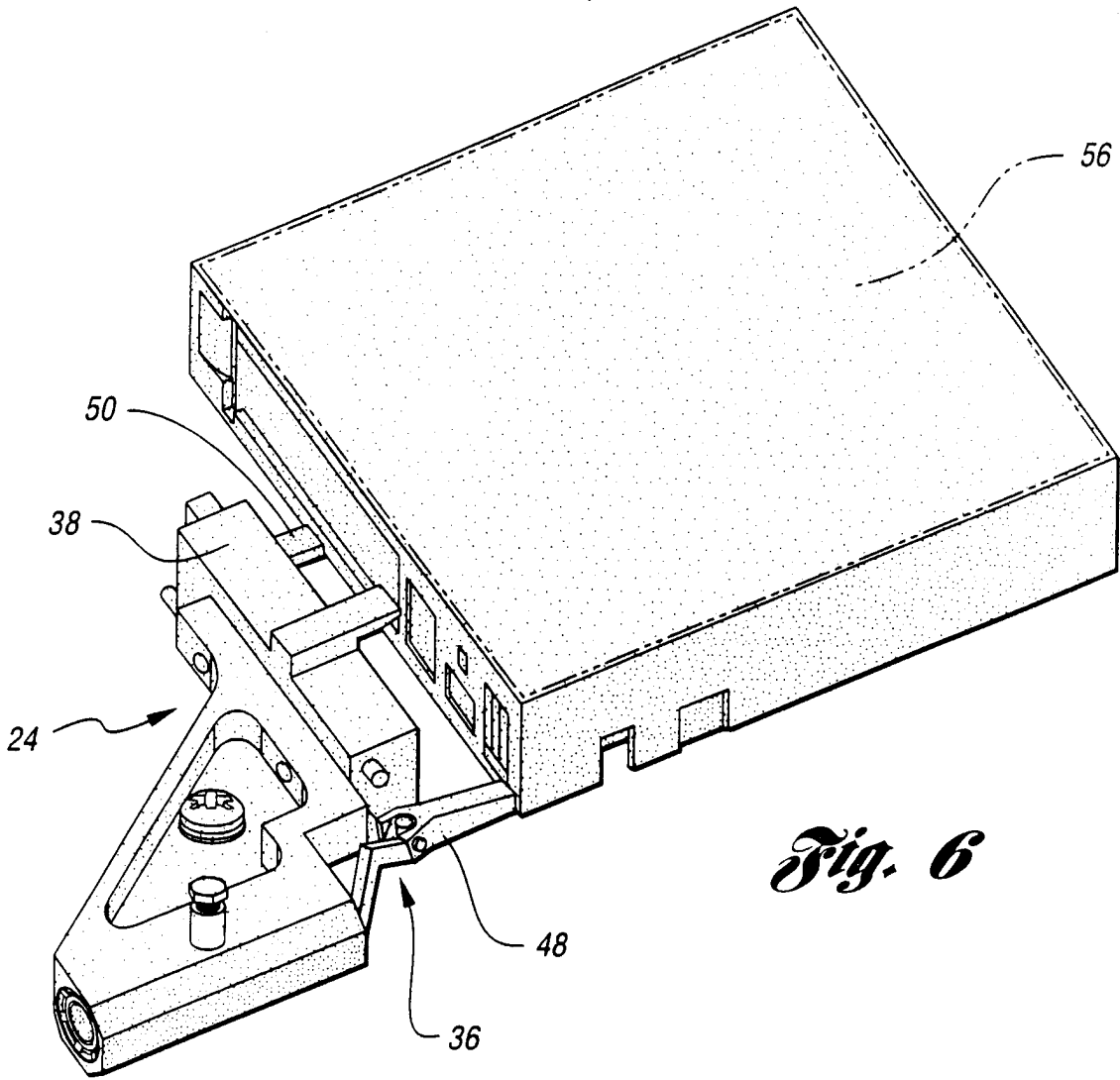


Fig. 6

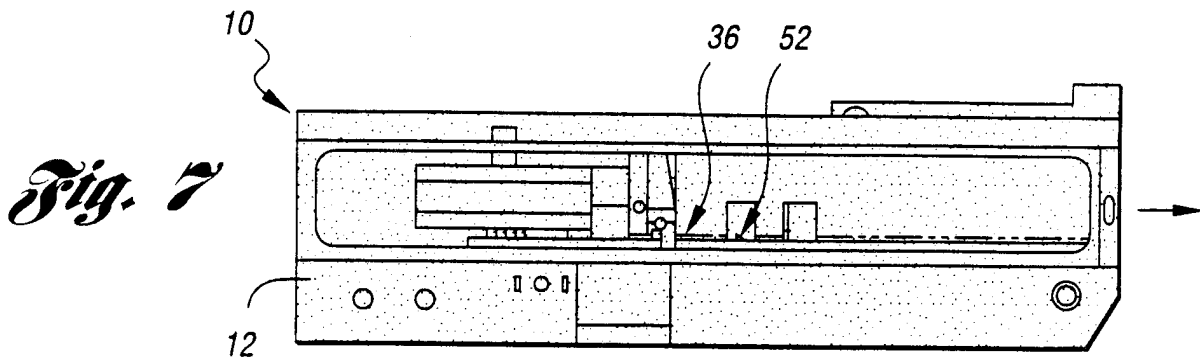


Fig. 7

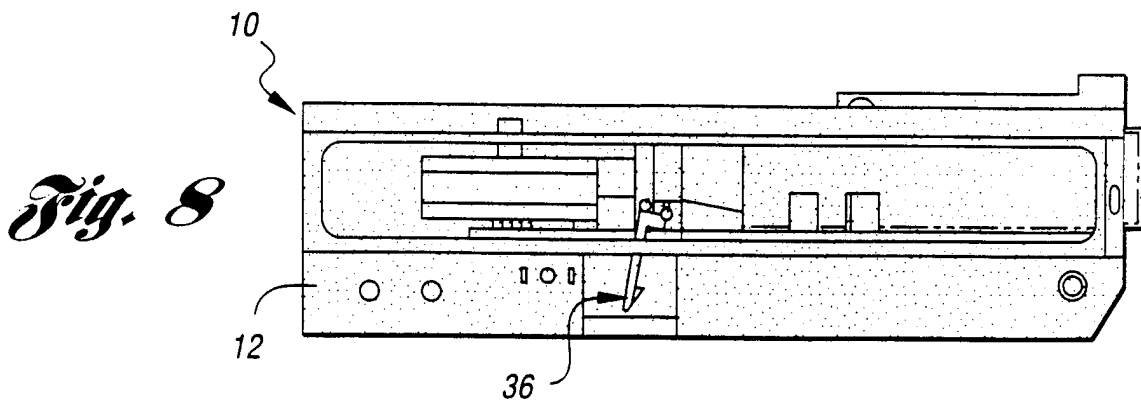
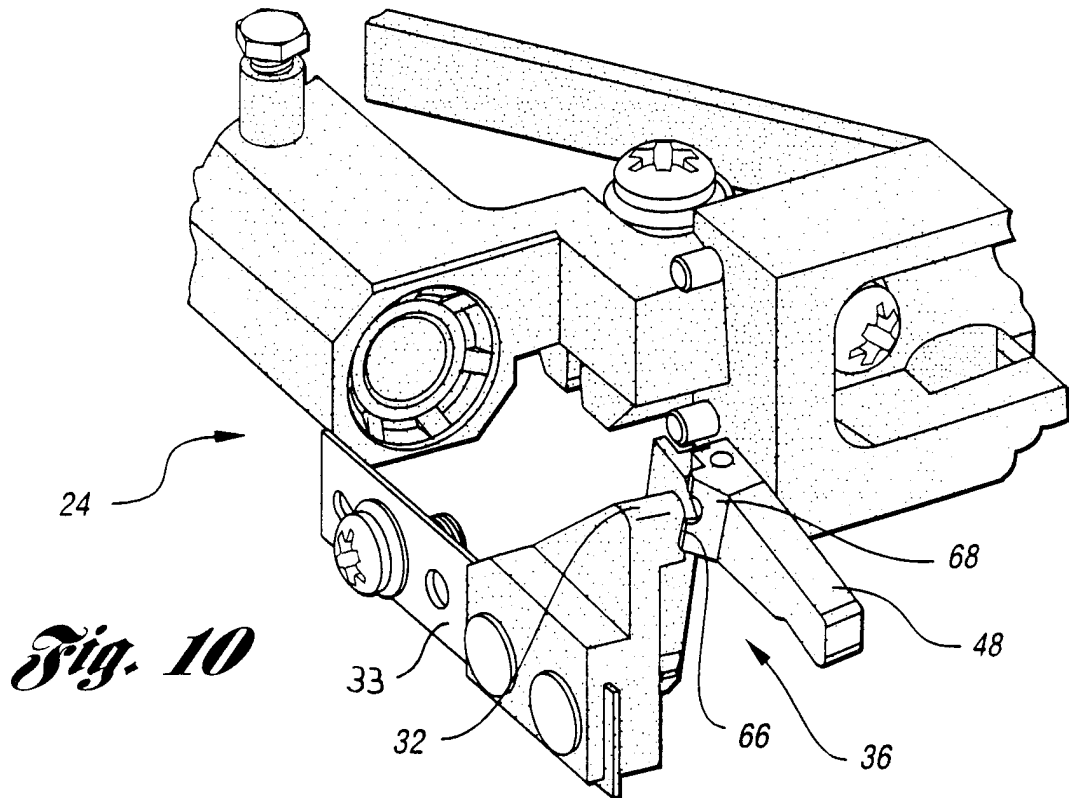
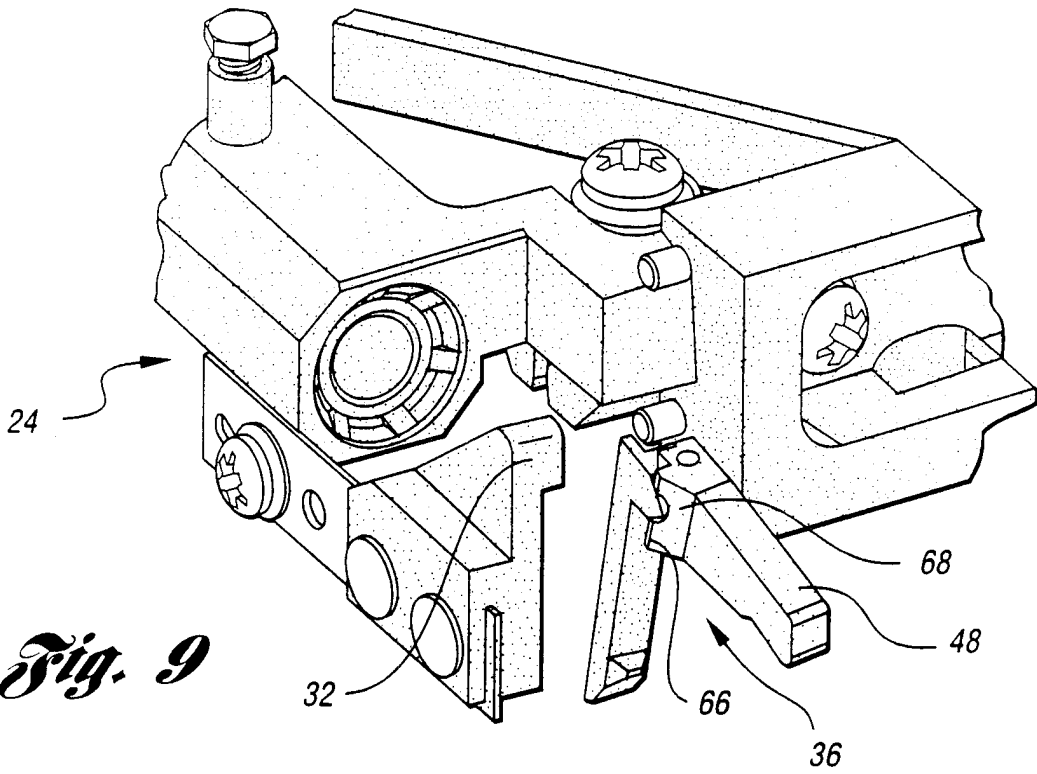


Fig. 8



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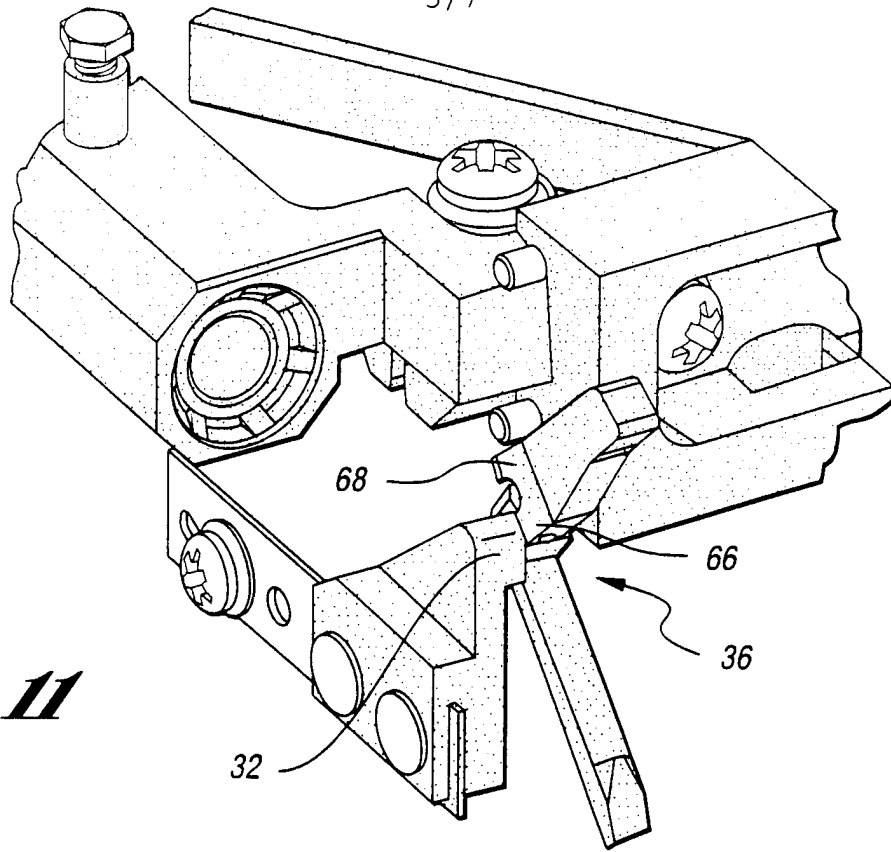


Fig. 11

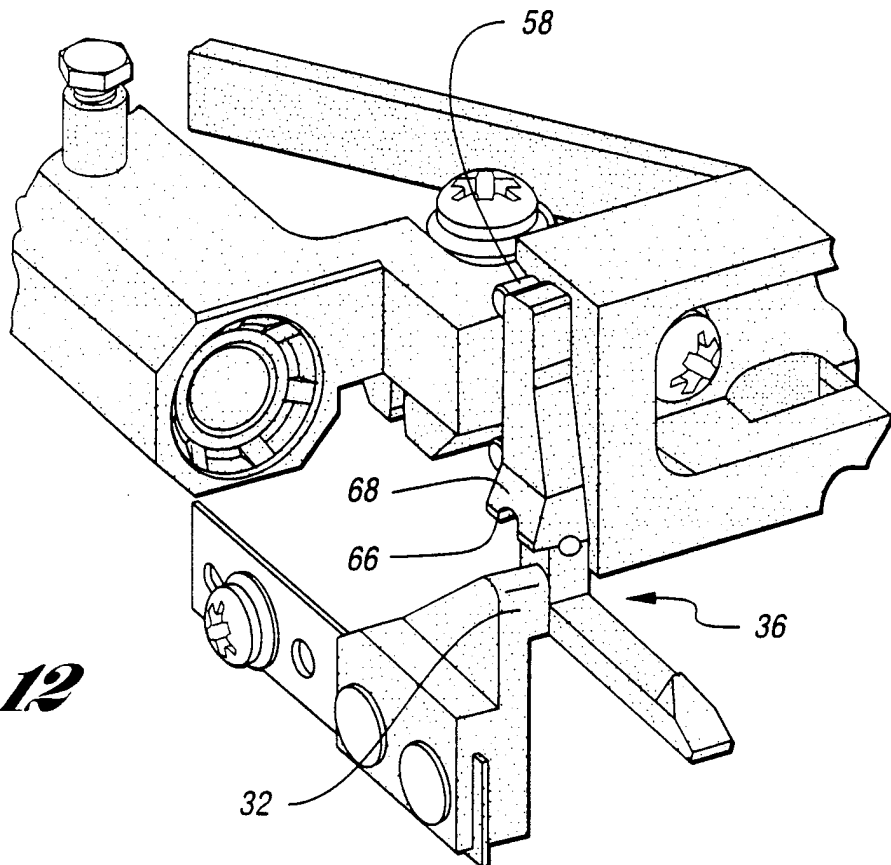


Fig. 12

Fig. 13

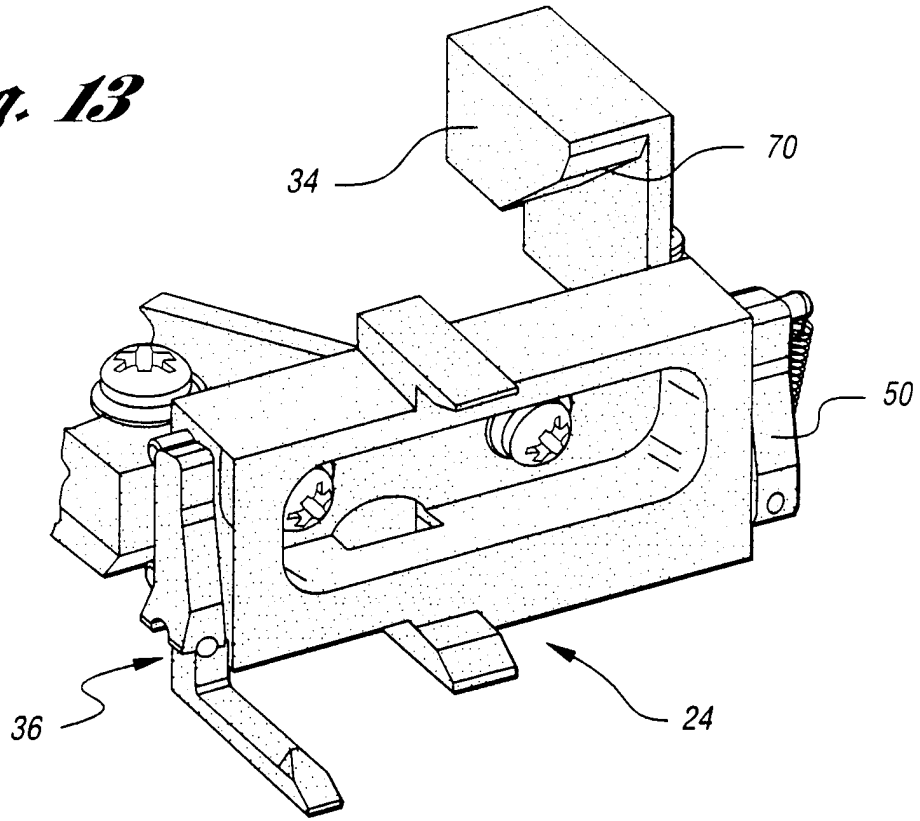
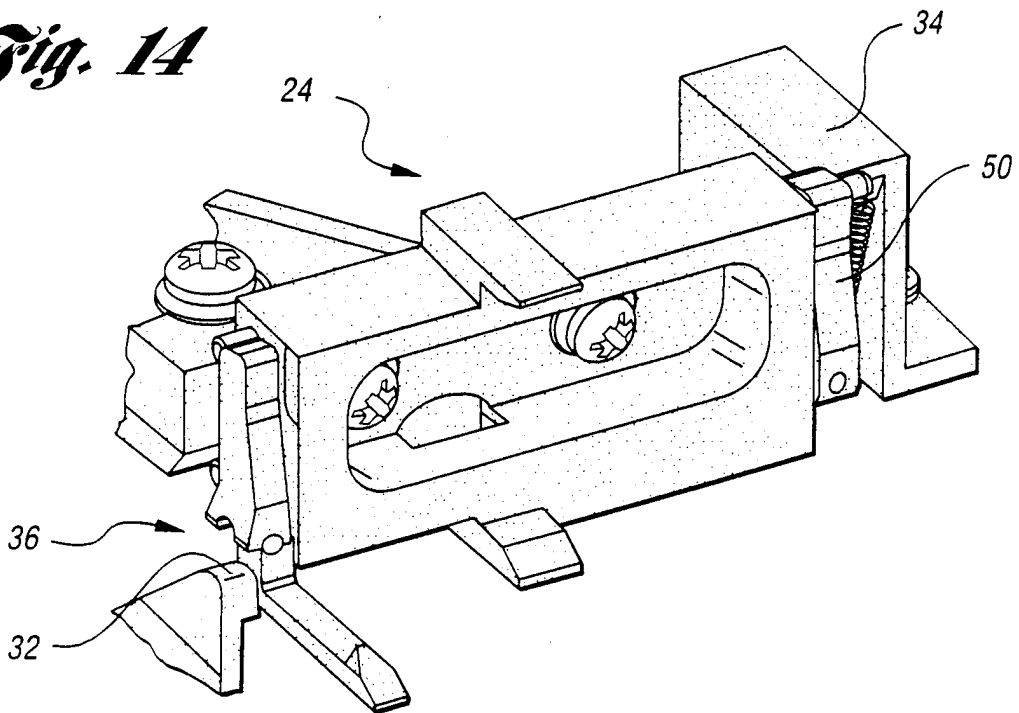


Fig. 14



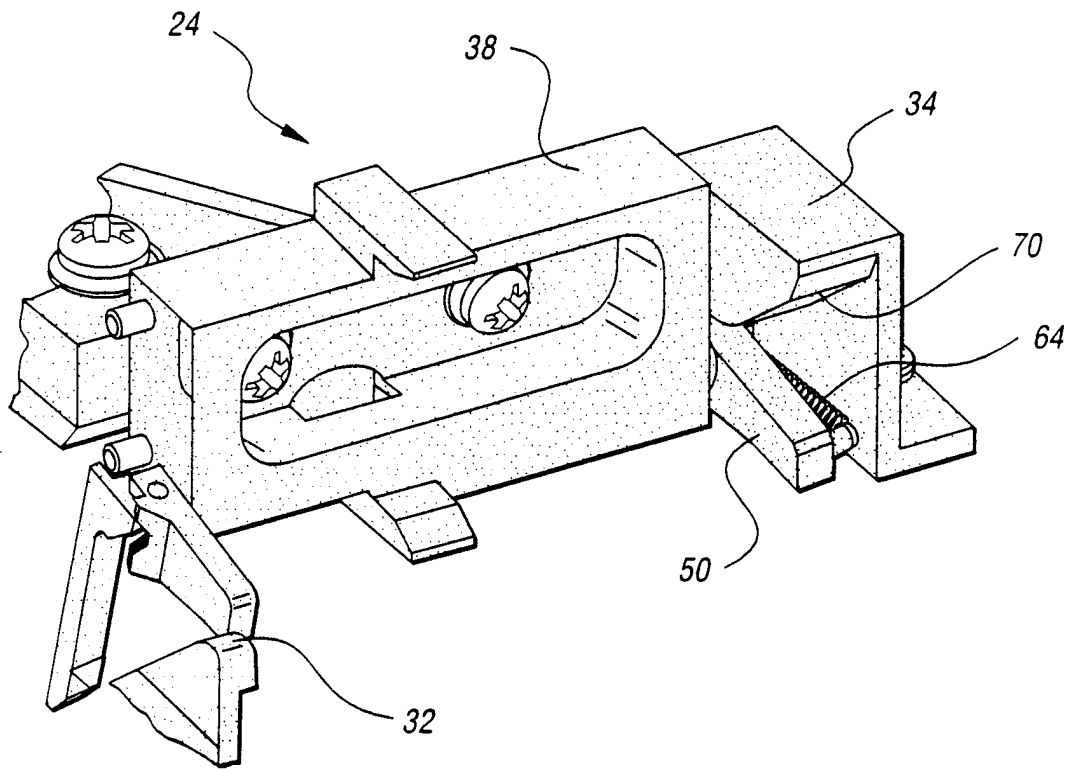


Fig. 15

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/19364

A. CLASSIFICATION OF SUBJECT MATTER
 IPC(6) : B 65 G 1/02
 US CL : 414/280
 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)
 U.S. : 414/280, 281, 751, 753

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)


C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| Y | US 5,588,796 A (Ricco et al) 31 December 1996, see figures 6-17. | 1-15 |
| Y | US 4,614,474 A (Sudo) 30 September 1986, see entire document. | 1-15 |
| A | US 4,903,252 A (Tanaka et al) 20 February 1990. | |

Further documents are listed in the continuation of Box C. See patent family annex.

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