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(54) Title: CLAMP

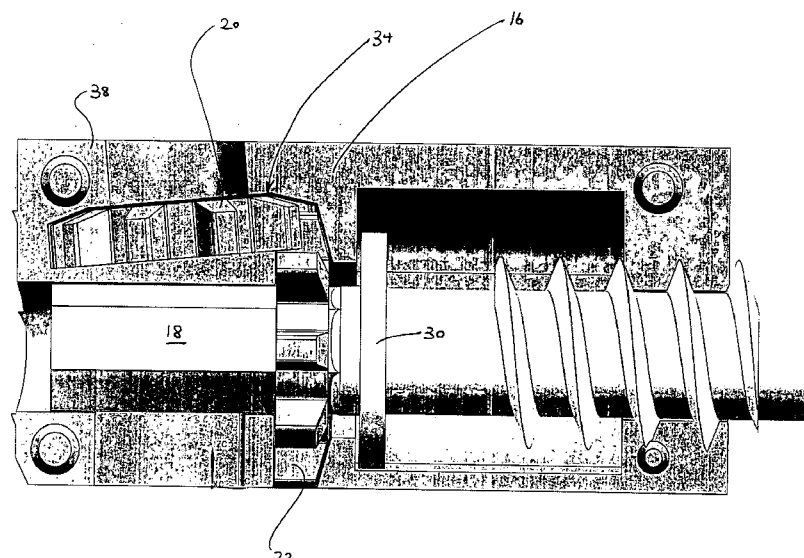


FIG. 13

(57) Abstract: A clamp for clamping a first part to a second part, including a housing adapted to be retained relative to the first part, a shaft rotatably mounted to the housing, the shaft being threaded for threaded engagement with the second part, a first gear having a receptacle for receiving a tool and for transmitting rotation from the tool to the first gear, and a second gear for transmitting rotation from the first gear to the shaft, wherein the shaft slides relative to the second gear as the shaft is threaded into the second part.

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CLAMP

Field of the Invention

5 The invention relates to a clamp, and more particularly, but not exclusively, to a one piece (or single unit) clamp for clamping together furniture/cabinet components.

Background of the Invention

10 It is known to provide clamps for clamping together furniture components. For example, it is known to provide a clamping assembly for clamping together furniture components, wherein the clamping assembly has two clamping members which are drawn together by way of a threaded engagement. However, the applicant has identified that clamping assemblies of that type are not always suitable, as it is sometimes impractical to
15 embed one clamping member in each of the furniture components. For example, the applicant has identified that such typical clamping assemblies may not be suitable for use in a 90 degree joint between panels of furniture.

 The applicant has previously proposed a one piece clamp for holding together
20 panels of furniture in a 90 degree arrangement, with a product marketed under the name "Zipbolt Fastfit". However, the applicant has identified that the Fastfit product has a relatively limited degree of tightening, and may not bite sufficiently into all materials. He has also identified that with the current trend towards the use of CNC Routers or Nesting Machines it would be beneficial for there to be provided an improved one piece clamp.

25

 Examples of the present invention seek to provide a clamp which overcomes or at least alleviates one or more disadvantages associated with previous clamps.

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Summary of the Invention

In accordance with one aspect of the present invention, there is provided a clamp for clamping a first part to a second part, including a housing adapted to be retained
5 relative to the first part, a shaft rotatably mounted to the housing, the shaft being threaded for threaded engagement with the second part, a first gear having a receptacle for receiving a tool and for transmitting rotation from the tool to the first gear, and a second gear for transmitting rotation from the first gear to the shaft, wherein the shaft slides relative to the second gear as the shaft is threaded into the second part.

10

Preferably, the threaded shaft is threadedly engaged with a mating thread in the housing, such that rotation of the shaft driven by the tool causes the shaft to move along a longitudinal axis of the shaft relative to the housing.

15 Preferably, the housing is shaped to engage within a recess formed in the first part to retain the clamp housing relative to the first part.

In a preferred form, the shaft extends through a central aperture of the second gear, and the shaft and central aperture are shaped such that driving rotation of the second gear
20 is transmitted from the second gear to the shaft. More preferably, the shaft has a non-circular cross-section, and the central aperture of the second gear has a non-circular cross-section corresponding to the cross-section of the shaft such that driving rotation of the second gear is transmitted from the second gear to the shaft. Even more preferably, the shaft has a hexagonal cross-section, and the central aperture of the second gear has a
25 hexagonal cross-section corresponding to the cross-section of the shaft such that driving rotation of the second gear is transmitted from the second gear to the shaft.

Preferably, the first gear and the second gear are identical parts.

30 In a preferred form, the clamp is adapted to provide a two stage clamping of the first and second parts, including a first stage in which the threaded shaft is driven into the

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second part maintaining an existing relative positioning of the first and second parts, and a second stage in which the first and second parts are clamped together. More preferably, the shaft has a rim which limits protrusion of the shaft beyond the housing during the second stage, and the shaft has a gap between the rim and a beginning of the thread to
5 enable rotation of the shaft relative to the housing with the shaft at the protrusion limit without driving longitudinal movement of the shaft relative to the housing. Even more preferably, the gap is at least as large as a width of the housing.

Preferably, the housing is formed as two parts, with a cavity between the two parts
10 to house the shaft and gears.

Brief Description of the Drawings

The invention is described, by way of non-limiting example only, with reference to
15 the accompanying drawings, in which:

Figure 1 is a perspective view of a clamp in accordance with an example of the present invention, shown without one half of a housing thereof;

20 Figure 2 is a side view of an internal mechanism of the clamp;

Figure 3 is a perspective view of one side of the clamp, shown with one half of the housing removed;

25 Figure 4 is a perspective view of the other side of the clamp, with the other half of the housing removed;

Figure 5 is a side view of the arrangement shown in Figure 4;

30 Figure 6 is a side view of the arrangement shown in Figure 3;

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Figure 7 shows detail of the threaded shaft;

Figure 8 shows detail of two half portions of the housing;

5 Figure 9 shows details of dimensions of the clamp;

Figure 10 shows an embodiment of the assembled clamp prior to use in clamping two parts;

10 Figure 11 shows a clamp in accordance with another example of the present invention, and a furniture component;

Figure 12 shows a gear of the clamp shown in Figure 11; and

15 Figures 13 to 18 show diagrammatic views of a clamp similar to the one shown in Figures 11 and 12.

Detailed Description

20 With reference to Figures 1 to 10, there is shown a clamp 10 which is suitable for use in clamping together furniture components, especially in a 90 degree arrangement of furniture panels as shown in Figure 10. The clamp 10 is embedded in a recess 26 formed in a first part 12 (of furniture panel), and is operated by way of a tool (for example an allen key) to drive a threaded shaft 18 of the clamp 10 into a second part 14 (or furniture panel).
25 Advantageously, the clamp 10 is adapted to provide a two-stage tightening process wherein the first stage involves threaded engagement of the threaded shaft 18 in the second part 14, and the second stage involves drawing together of the two parts 12, 14.

More specifically, the detailed operation of the clamp 10 is described with
30 reference to Figures 1 to 9. These drawings show a clamp 10 for clamping the first part 12 to the second part 14, including a housing 16 adapted to be retained relative to the first part

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12. The clamp 10 also includes a shaft 18 rotatably mounted to the housing 16, the shaft 18 being threaded for threaded engagement with a bore 19 in the second part 14. The clamp 10 also includes a first gear 20 and a second gear 22 for transmitting drive from a tool to the shaft 18. More particularly, the first gear 20 has a receptacle 24 for receiving a tool and for transmitting rotation from the tool to the first gear 20, whereas the second gear is for transmitting rotation from the first gear 20 to the shaft 18. The shaft 18 slides relative to the second gear 22 when the shaft 18 is threaded into the second part 14.

As can be seen in Figure 1, the threaded shaft 18 is threadedly engaged with a mating female thread in the housing 16, such that rotation of the shaft 18 driven by the tool causes the shaft 18 to move along a longitudinal axis of the shaft 18 relative to the housing 16. In this way, the shaft 18 is positively driven outwardly of the housing 16 when the first gear 20 is rotated.

The housing 16 is shaped to engage within the recess 26 formed in the first part 12 to retain the clamp housing 16 relative to the first part 12. As can be seen in Figure 10, the housing 16 has a bulbous circular end which is unable to pass through a narrow throat 27 of the recess 26, such that the housing 16 is effectively retained relative to the first part 12.

Returning to the mechanical operation of the clamp 10, the shaft 18 extends through a central aperture 28 of the second gear 22, and the shaft 18 and central aperture 28 are shaped such that driving rotation of the second gear 22 is transmitted from the second gear 22 to the shaft 18. The shaft 18 has a hexagonal cross-section along part of its length, and the central aperture 28 of the second gear 22 has a matching hexagonal cross-section corresponding to the cross-section of the shaft 18 such that driving rotation of the second gear 22 is transmitted from the second gear 22 to the shaft 18. Although the example shown in the drawings depicts the cross-section of a proximal portion of the shaft 18 to be hexagonal and the matching cross-section of the central aperture 28 to also be hexagonal, it will be understood by those skilled in the art that other non-circular cross-sectional shapes would also serve the purpose of transmitting driving rotation from the

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second gear 22 to the shaft 18 (for example, a square cross-section, triangular cross-section, an oval cross-section, etc).

Advantageously, in the example shown in the drawings, the first gear 20 and the
5 second gear 22 are identical parts. This is beneficial as it reduces the total number of different parts that need to be manufactured to form the clamp 10. As the first gear 20 is identical to the second gear 22, the receptacle 24 of the first gear 20 is of the same dimensions as the central aperture of the second gear 22, and the hexagonal proximal portion of the shaft 18 is therefore of the same cross-sectional dimensions as the allen key
10 tool used to engage the first gear 20.

As seen clearly in Figure 2, the first gear 20 is tilted downwardly from the second gear 22 toward the shaft 18 to improve access to the receptacle 24, particularly when the clamp 10 is to be used close to a 90 degree joint of panels which may otherwise inhibit the
15 operator's accessibility to tighten the clamp 10.

The clamp 10 is adapted to provide a two stage clamping of the first and second parts 12, 14. These two stages include a first stage in which the threaded shaft 18 is driven into the second part 14 maintaining an existing relative positioning of the first and second
20 parts 12, 14, and a second stage in which the first and second parts 12, 14 are clamped together. The shaft 18 has a rim 30 which separates the hexagonal proximal portion of the shaft 18 and the threaded distal portion of the shaft 18. The rim 30 limits protrusion of the shaft 18 beyond the housing 16 during the second stage. The shaft 18 also has a gap 32 between the rim 30 and a beginning of the thread to enable rotation of the shaft 18 relative
25 to the housing 16 with the shaft 18 at the protrusion limit without driving longitudinal movement of the shaft 18 relative to the housing 16. The gap 32 is at least as large as a width of the housing 16 at the distal wall of the housing 16.

The applicant has identified that without the gap 32, the thread of the shaft 18
30 would be threadedly engaged with the female thread formed in the distal wall of the housing 16 even when the rim 30 abuts against the distal wall with the shaft 18 at its

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protrusion limit. If that were the case, the shaft 18 would cease to be able to rotate relative to the housing 16, and it would not be possible for further rotation of the shaft 18 to draw the second part 14 closer to the first part 12 in a clamped abutment.

5 In the preferred embodiment shown, the housing 16 is formed as two parts, with a cavity between the two parts to house the shaft 18 and gears 20, 22. The two parts are held together by way of pins of one part which extend through apertures formed in the other part, with the pins flared to prevent the two parts from coming apart. In an alternative example, one part of the housing may be formed with shorter pins and the other part may
10 be formed with limited depth recesses/bores (rather than through holes), and the two parts may be held together by a friction fit (of the pins within the recesses/bores) and/or with the assistance of glue.

 With reference to Figures 11 to 18, there is shown a clamp 10 in accordance with
15 an alternative example of the present invention which includes various modifications over the clamp shown in Figures 1 to 10. In particular, Figures 11 and 12 show that the housing 16 and the gears 20, 22 are made of metal. More specifically, the housing 16 is formed as two half shell portions, with each half being formed by die-casting Zamak material, which is an alloy with a base metal of zinc and alloying elements of aluminium, magnesium and
20 copper. Although Figure 11 shows the tip of the shaft 18 protruding from the housing 16 when in the fully retracted state, in other examples it may be possible to fully retract the shaft 18 so that the tip of the shaft is flush with the housing 16. The shaft 18 may be formed from mild steel.

25 Figure 12 shows a gear which may be used for both the first gear 20 and the second gear 22, such that the first gear 20 and the second gear 22 are formed of interchangeable identical parts. The gear may be formed of alloy steel, with high carbon content for toughness. One face of the gear may be flat, with the opposite face having a slight convex curvature to assist in keeping the gear snug within the housing 16, and to ensure the gear
30 can only be inserted in the correct orientation. The gear may have seven teeth, and each of the teeth may be rounded. The rounding of the teeth may assist in compensating for slight

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shape variations caused during the stamping production process, to ensure that the gears operate smoothly even with minor manufacturing variations. The metal teeth of the metal gears may be significantly stronger than gears formed of plastic material, and may also provide good resistance to unwanted creep and compression.

5

With reference to Figures 13 to 18, there are shown various views depicting changes made to the internal configuration of the housing 16 to accommodate (and complement) the curved gears 20, 22 of the kind shown in Figure 12. The general configuration of the clamp 10 shown in Figures 13 to 18 is similar to the configuration of
10 the clamp 10 shown in Figures 1 to 10, and like features are labelled with like reference numerals. The main difference resides in that the housing 16 includes cavities 34 which are correspondingly tapered to house the gears 20, 22 having curved faces. As can be seen in Figure 13, the curved face of the first gear 20 faces away from the shaft 18, and the curved face of the second gear 22 faces toward the threaded end of the shaft 18. The
15 housing 16 also has an additional support partition 36 which, in use, sits between the second gear 22 and the rim 30.

Specifically, Figure 13 shows a left-hand shell portion 38 of the housing 16 with the shaft 18 fitted therein, Figure 14 shows the left-hand shell portion 38 with the shaft 18
20 removed, Figure 15 shows cavity detail of the left-hand shell portion 38, Figure 16 shows cavity detail of a right-hand shell portion 40, Figure 17 shows the right-hand shell portion 40 with the shaft 18 located therein, and Figure 18 shows detail of the right-hand shell portion 40 with the shaft 18 and the second gear 22 mounted therein. The length of the hexagonal portion of the shaft 18 may be tailored to ensure correct seating within the
25 second gear 22 when the shaft 18 is fully extended.

While various embodiments of the present invention have been described above, it should be understood that they have been presented by way of example only, and not by way of limitation. It will be apparent to a person skilled in the relevant art that various
30 changes in form and detail can be made therein without departing from the spirit and scope

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of the invention. Thus, the present invention should not be limited by any of the above described exemplary embodiments.

5 In particular, the threaded engagement of the shaft in the second part could, in an alternative example, be by way of threaded engagement of the shaft in a nut (or other body) embedded in the second part. Also, the shaft could be shaped with an oval cross-section which is received in an oval hole in the second part such that when the shaft is rotated (for example by 90 degrees) the shaft is tightly retained within the hole.

10 The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as an acknowledgment or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavour to which this specification relates.

15

Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or
20 steps.

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A clamp for clamping a first part to a second part, including a housing adapted to be retained relative to the first part, a shaft rotatably mounted to the housing, the shaft being threaded for threaded engagement with the second part, a first gear having a receptacle for receiving a tool and for transmitting rotation from the tool to the first gear, and a second gear for transmitting rotation from the first gear to the shaft, wherein the shaft slides relative to the second gear as the shaft is threaded into the second part.
2. A clamp as claimed in claim 1, wherein the threaded shaft is threadedly engaged with a mating thread in the housing, such that rotation of the shaft driven by the tool causes the shaft to move along a longitudinal axis of the shaft relative to the housing.
3. A clamp as claimed in claim 1 or claim 2, wherein the housing is shaped to engage within a recess formed in the first part to retain the clamp housing relative to the first part.
4. A clamp as claimed in any one of claims 1 to 3, wherein the shaft extends through a central aperture of the second gear, and the shaft and central aperture are shaped such that driving rotation of the second gear is transmitted from the second gear to the shaft.
5. A clamp as claimed in claim 4, wherein the shaft has a non-circular cross-section, and the central aperture of the second gear has a non-circular cross-section corresponding to the cross-section of the shaft such that driving rotation of the second gear is transmitted from the second gear to the shaft.
6. A clamp as claimed in claim 5, wherein the shaft has a hexagonal cross-section, and the central aperture of the second gear has a hexagonal cross-section

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corresponding to the cross-section of the shaft such that driving rotation of the second gear is transmitted from the second gear to the shaft.

- 5 7. A clamp as claimed in any one of claims 1 to 6, wherein the first gear and the second gear are identical parts.
8. A clamp as claimed in claim 2, or any one of claims 3 to 7 when dependent on claim 2, wherein clamp is adapted to provide a two stage clamping of the first and second parts, including a first stage in which the threaded shaft is driven into the second part maintaining an existing relative positioning of the first and second parts, and a second stage in which the first and second parts are clamped together.
- 10 9. A clamp as claimed in claim 8, wherein the shaft has a rim which limits protrusion of the shaft beyond the housing during the second stage, and the shaft has a gap between the rim and a beginning of the thread to enable rotation of the shaft relative to the housing with the shaft at the protrusion limit without driving longitudinal movement of the shaft relative to the housing.
- 15 10. A clamp as claimed in claim 9, wherein the gap is at least as large as a width of the housing.
- 20 11. A clamp as claimed in any one of claims 1 to 10, wherein the housing is formed as two parts, with a cavity between the two parts to house the shaft and gears.
- 25 12. A clamp substantially as hereinbefore described with reference to the accompanying drawings.

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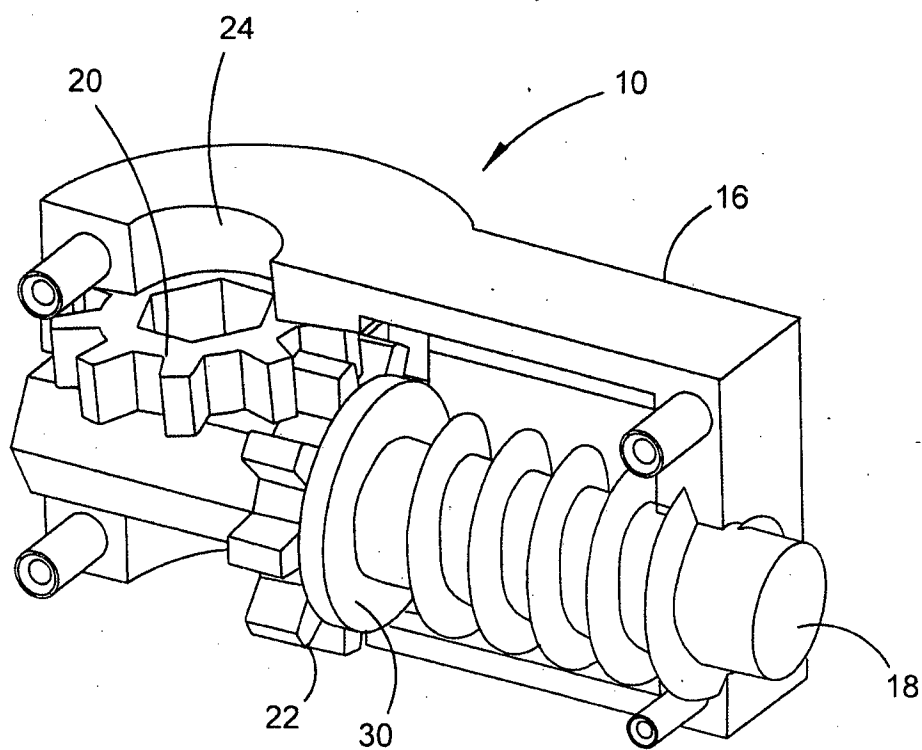


Figure 1

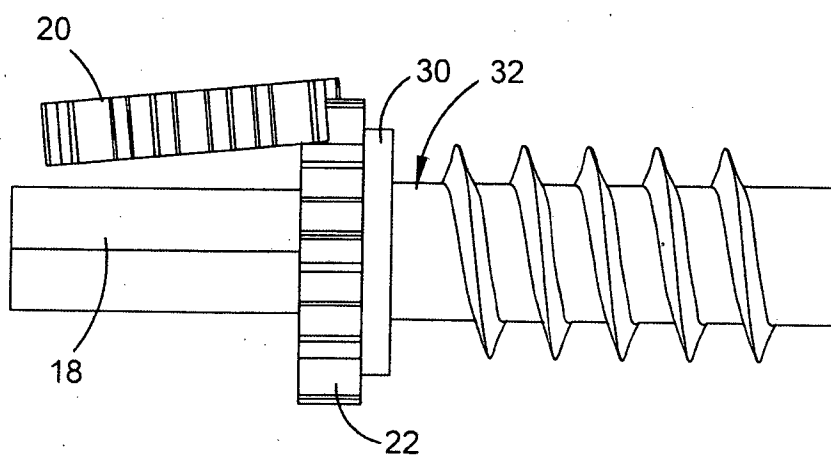


Figure 2

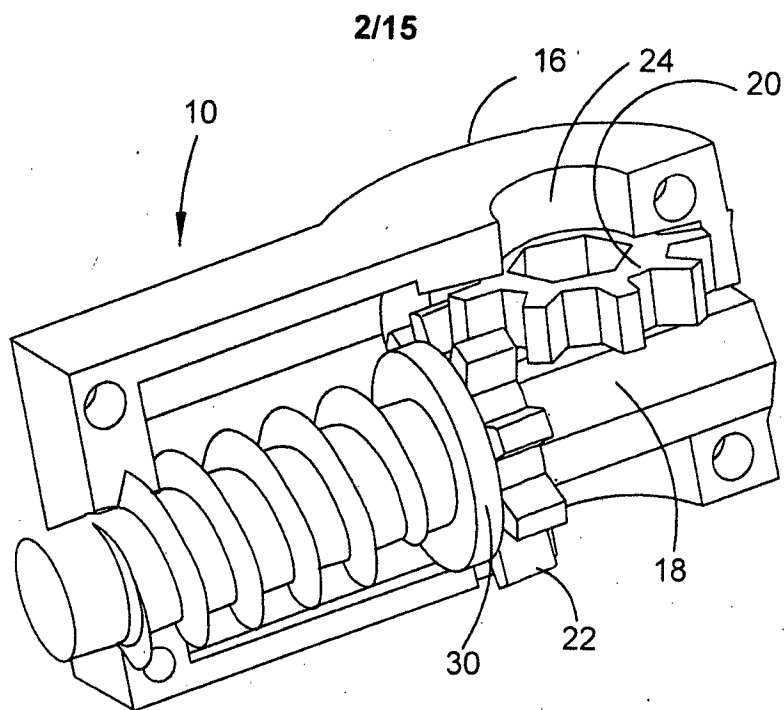


Figure 3

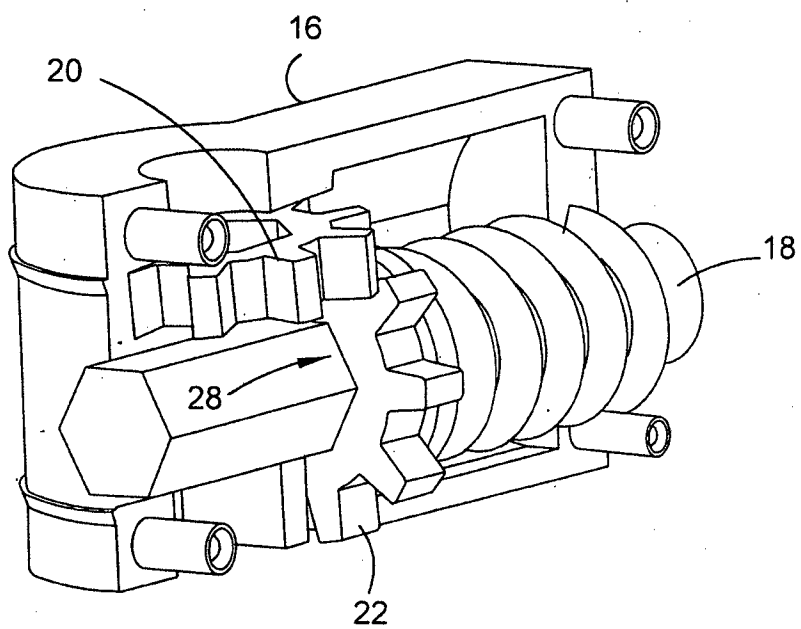


Figure 4

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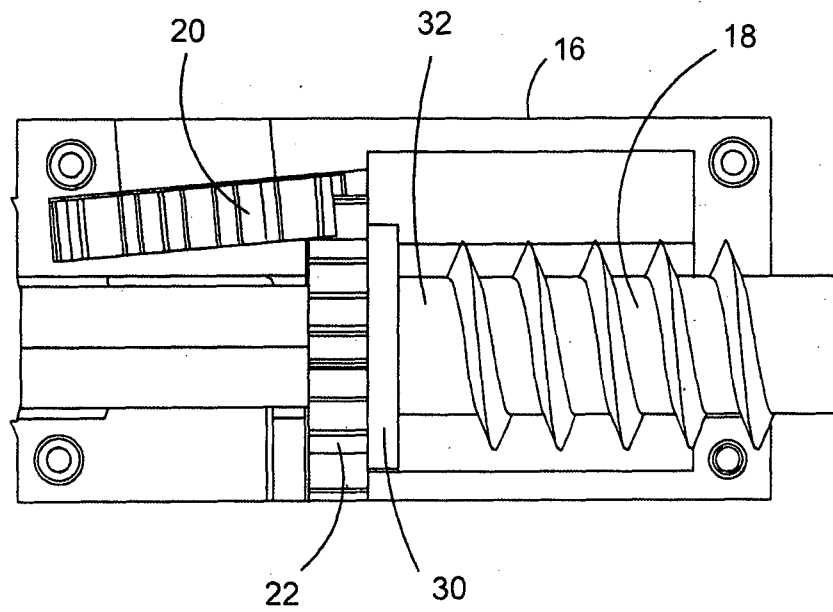


Figure 5

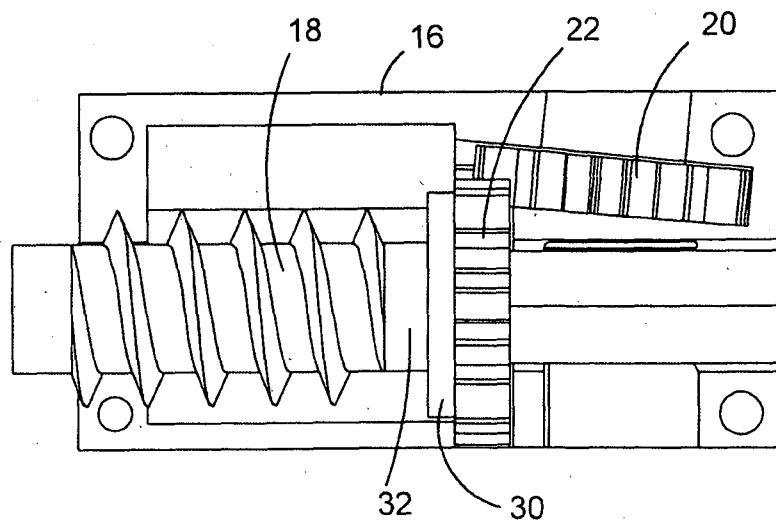
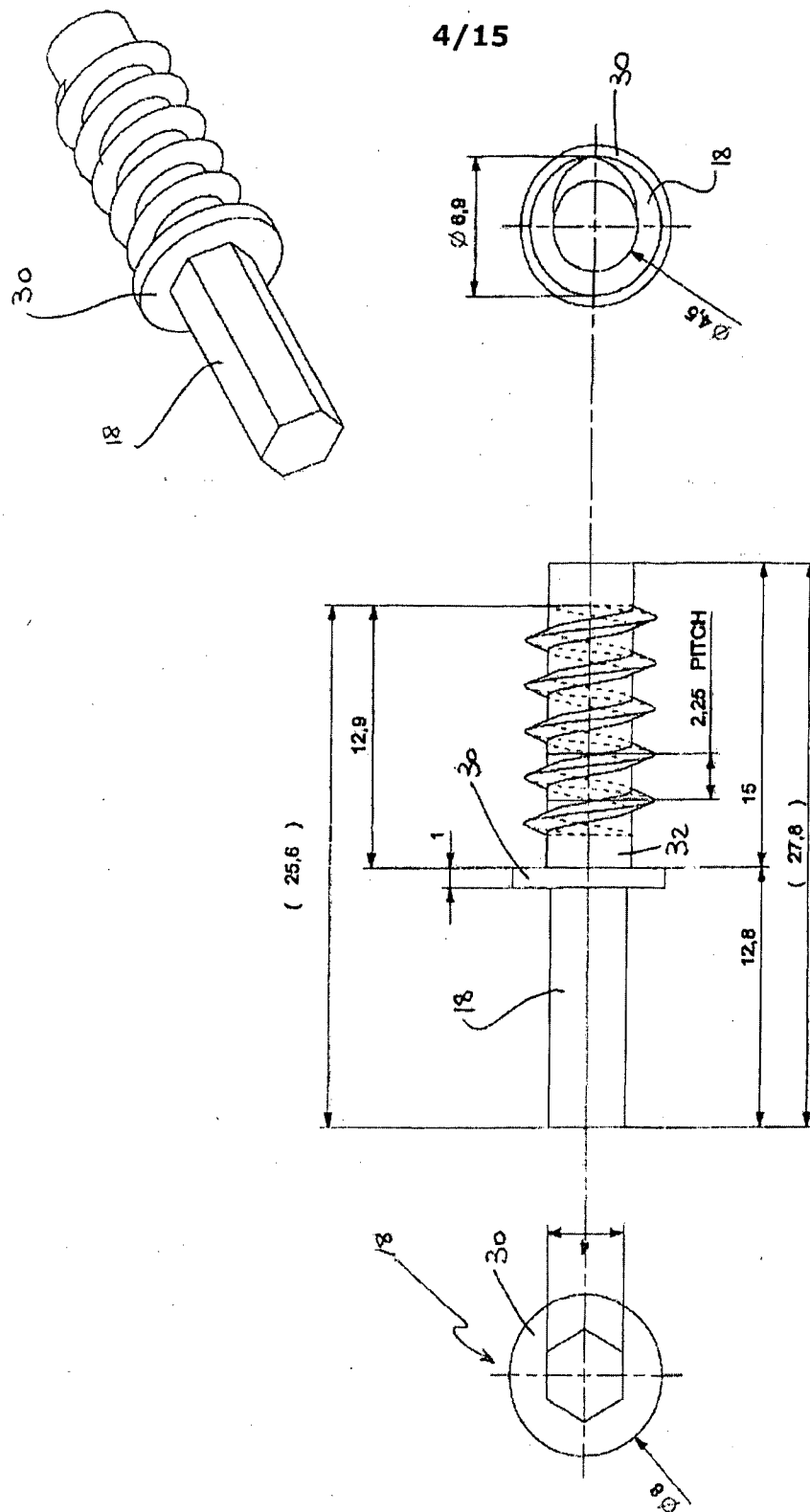


Figure 6



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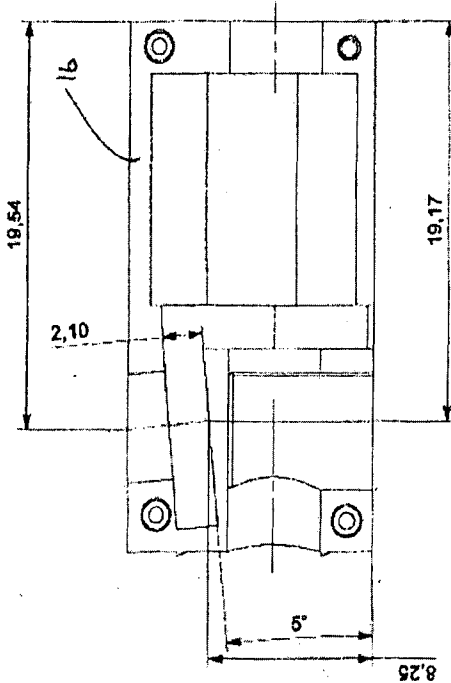
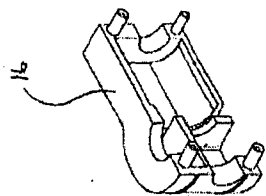
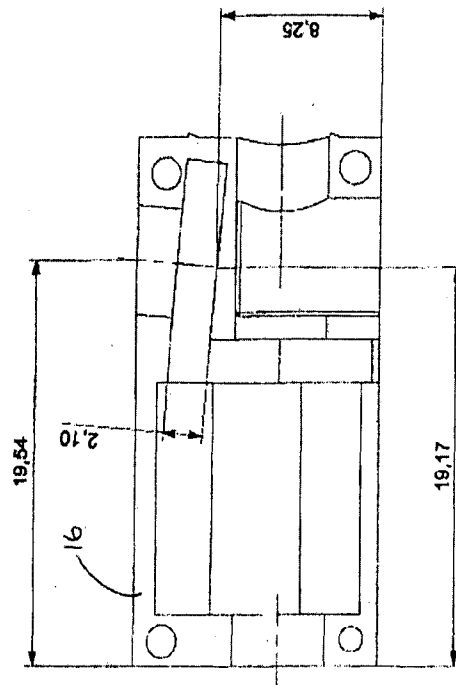
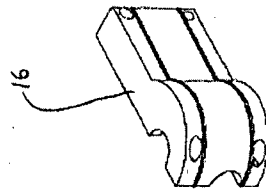


Figure 8

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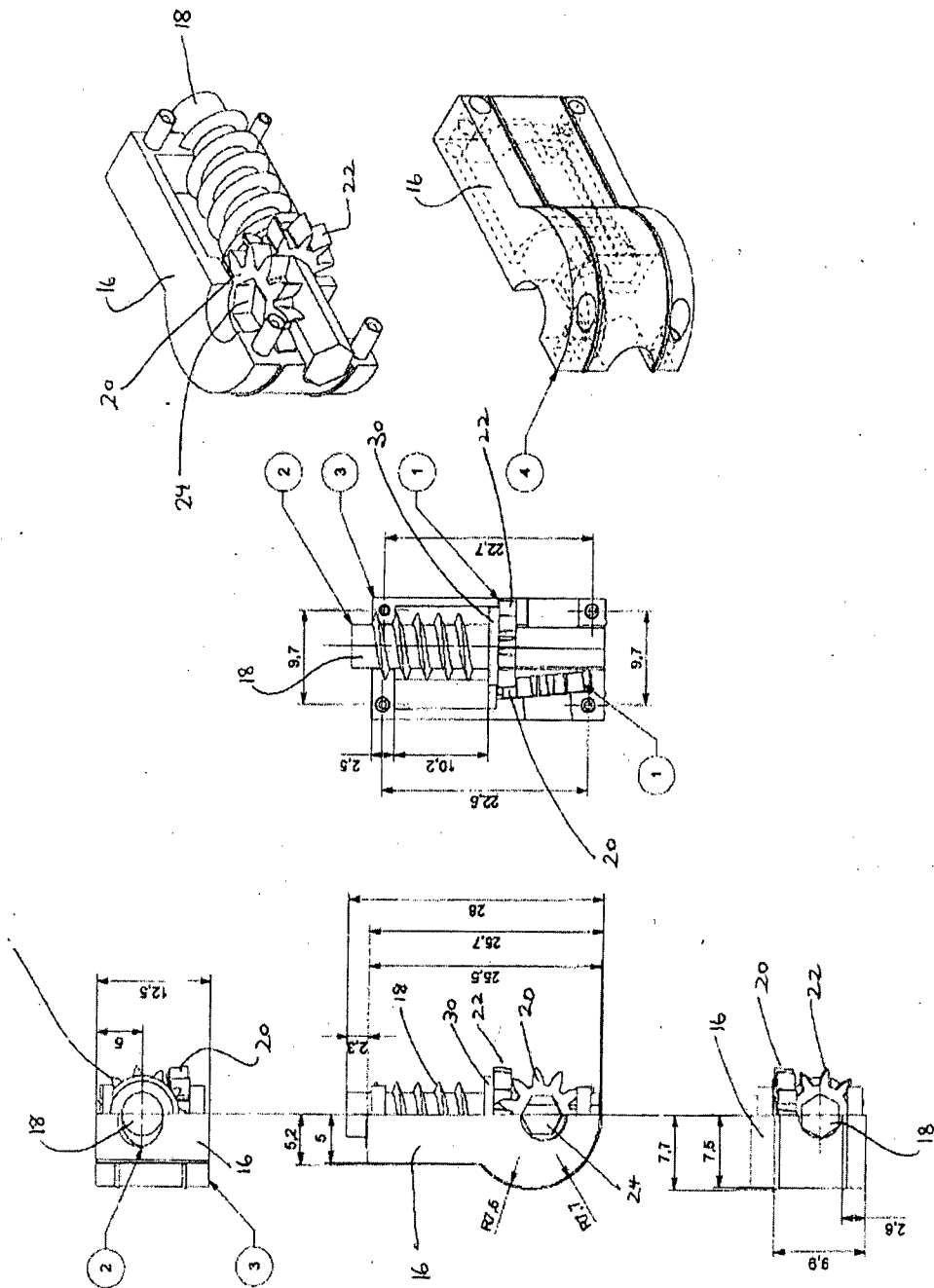


Figure 9

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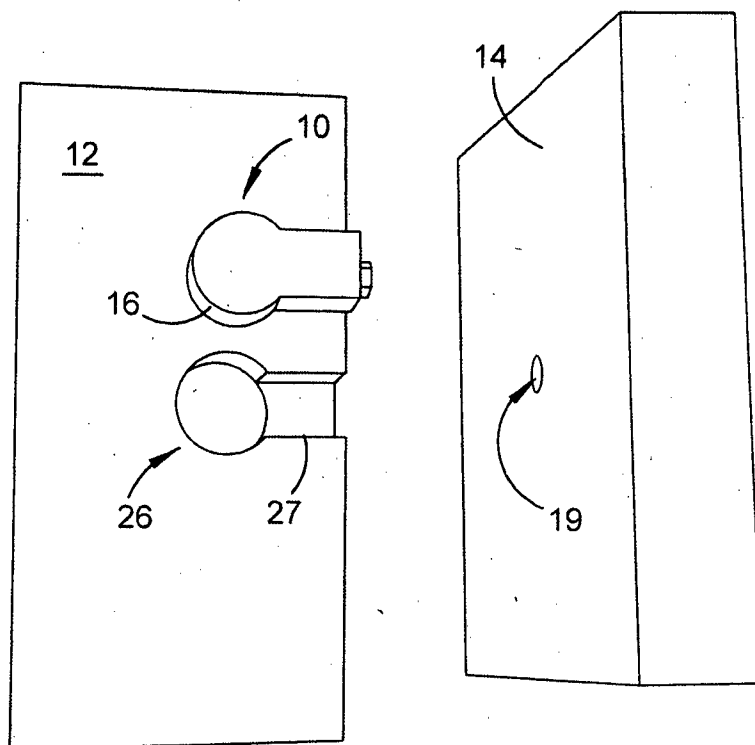


Figure 10

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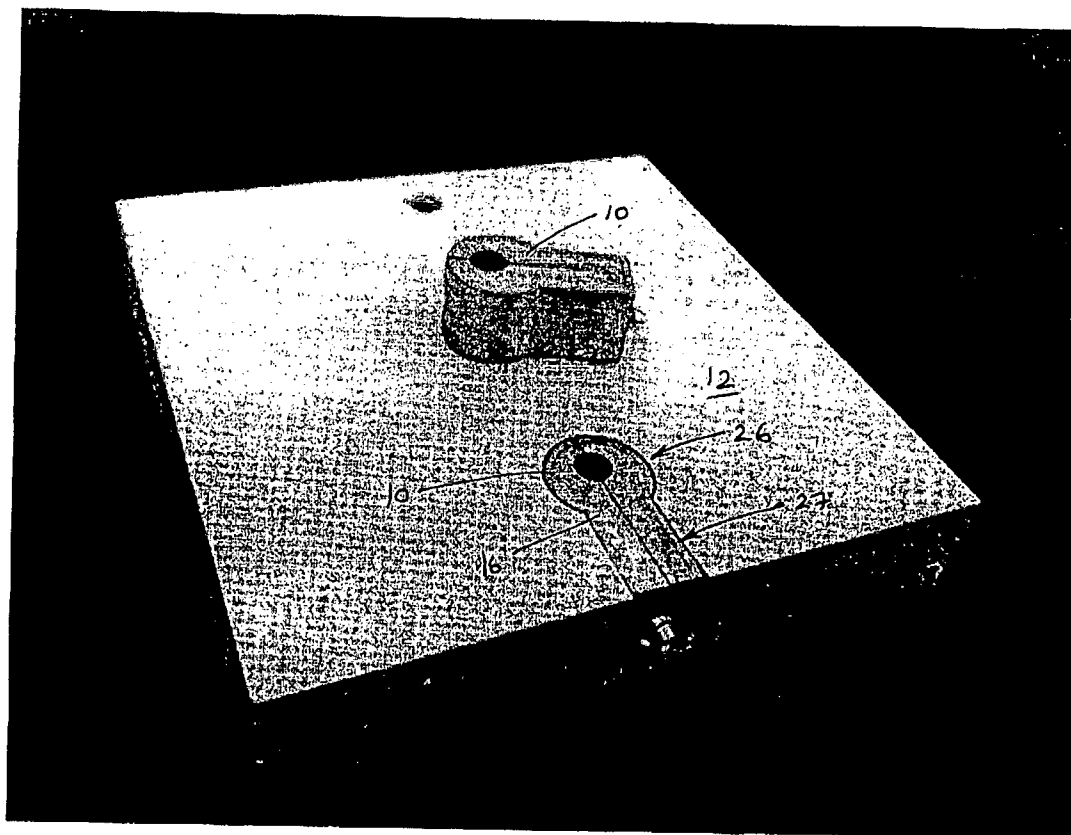


Figure 11

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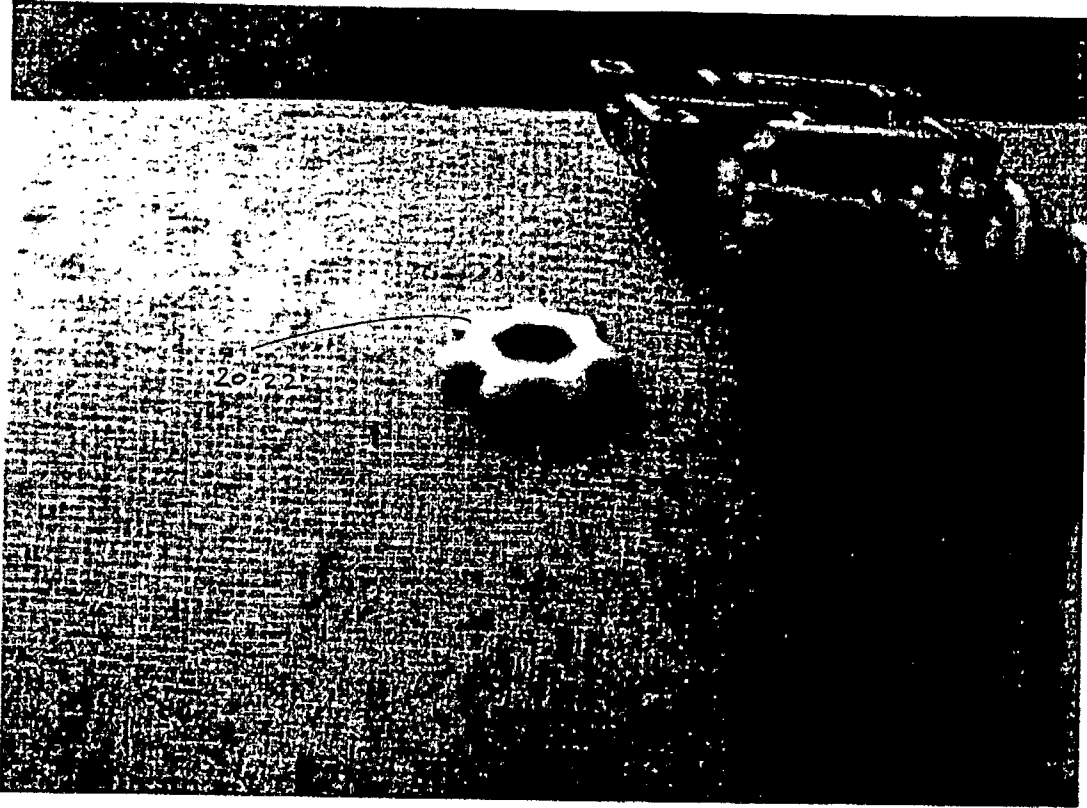


Figure 12

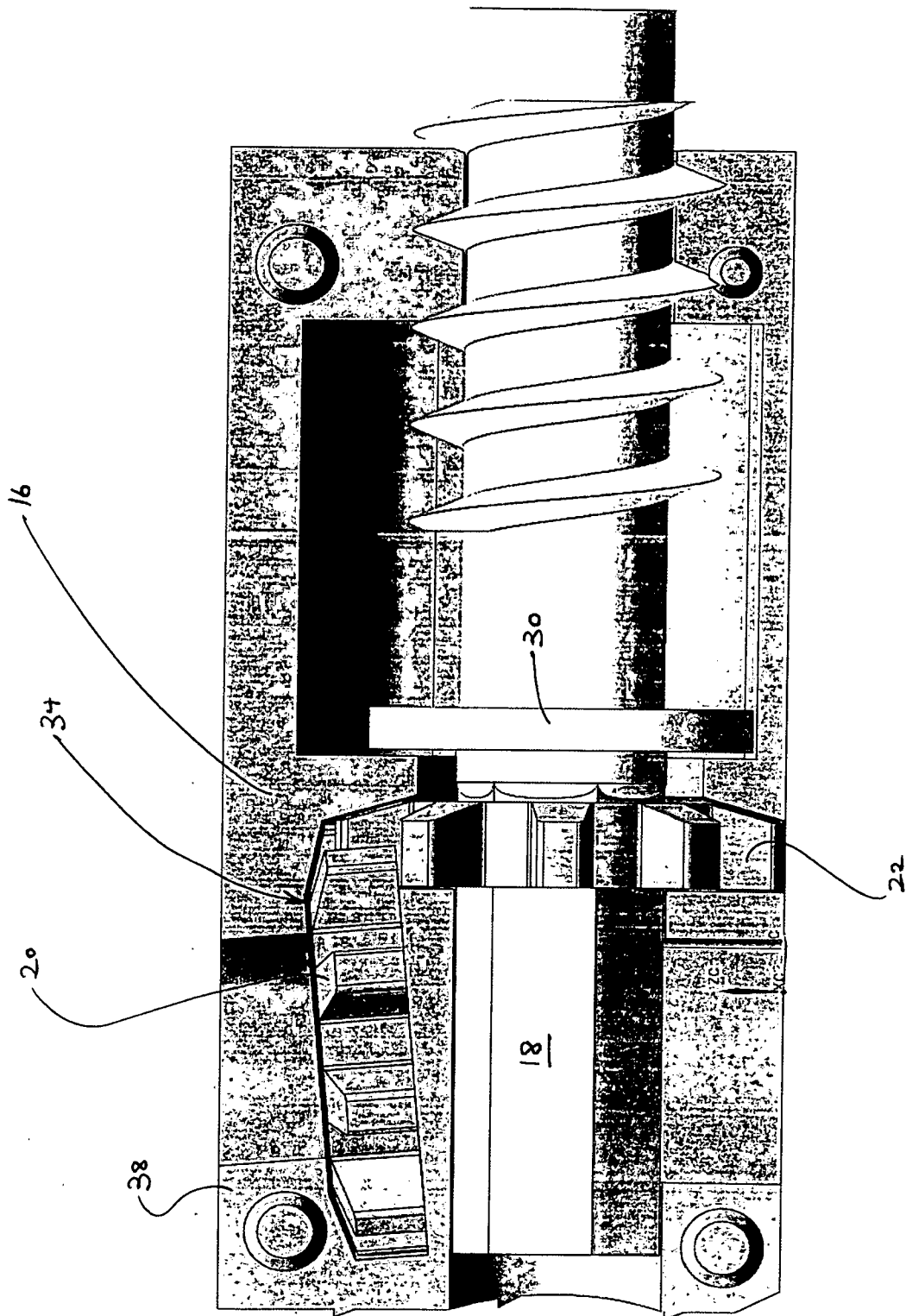
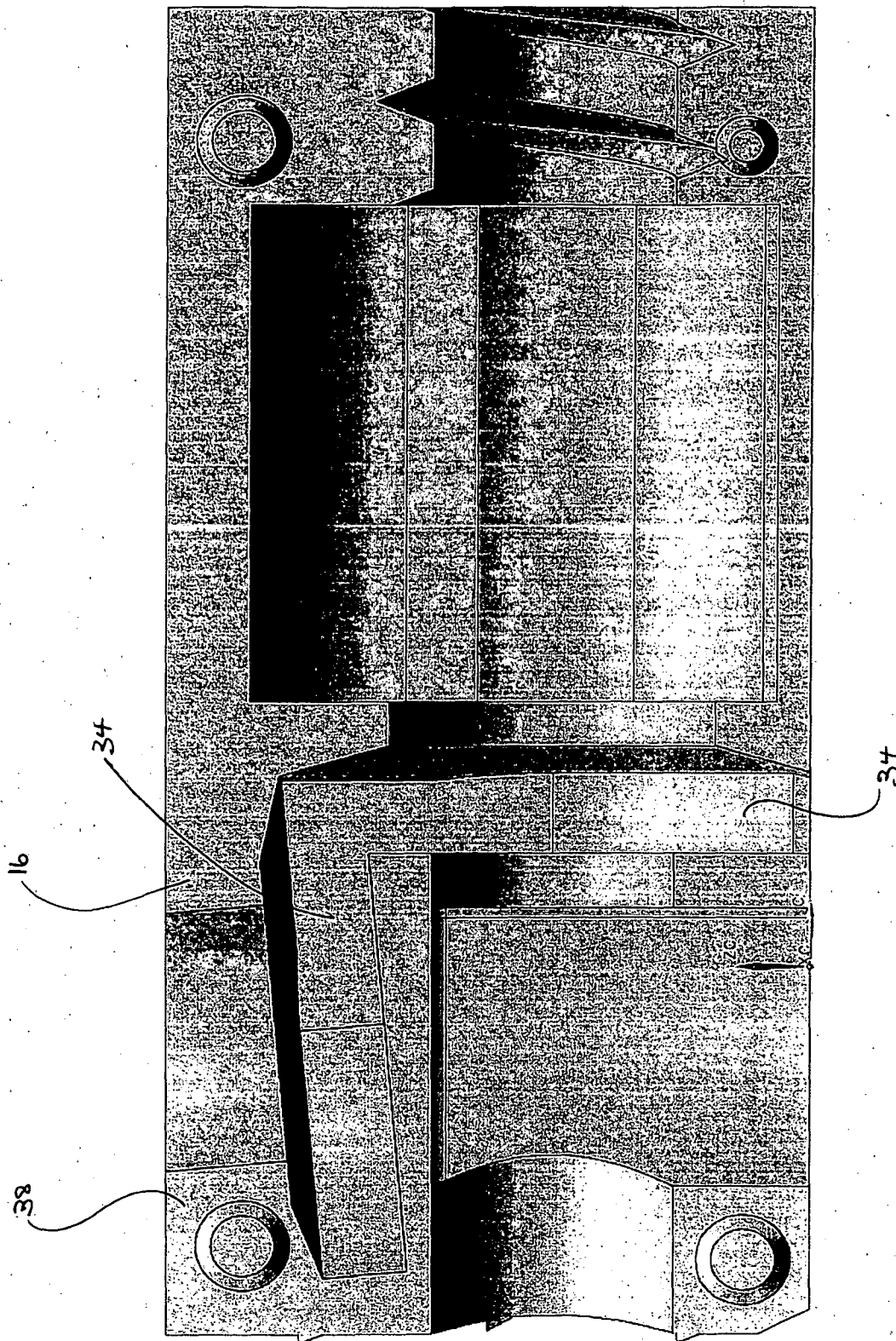


Figure 13
 (Rule 26) RO/AU



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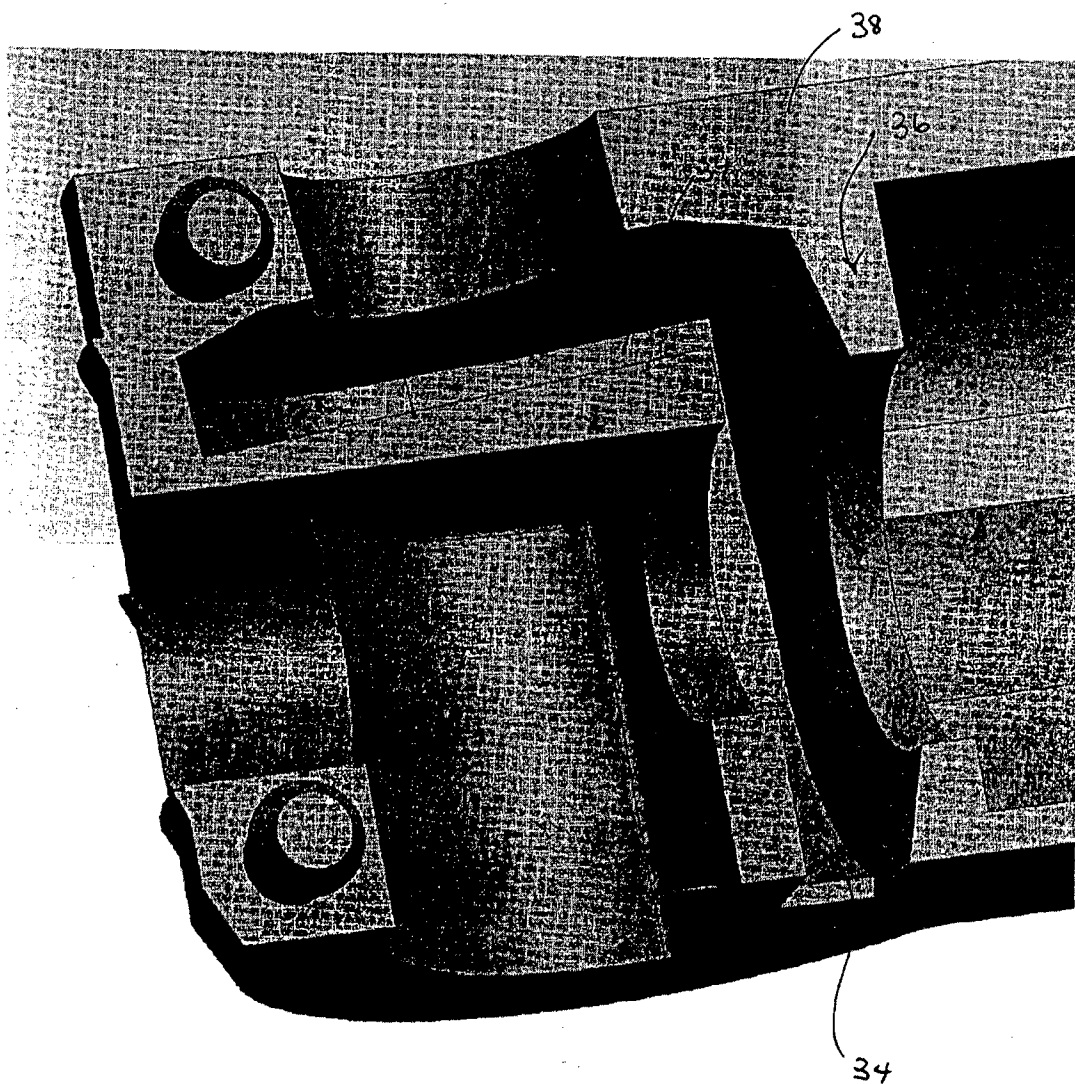


Figure 15

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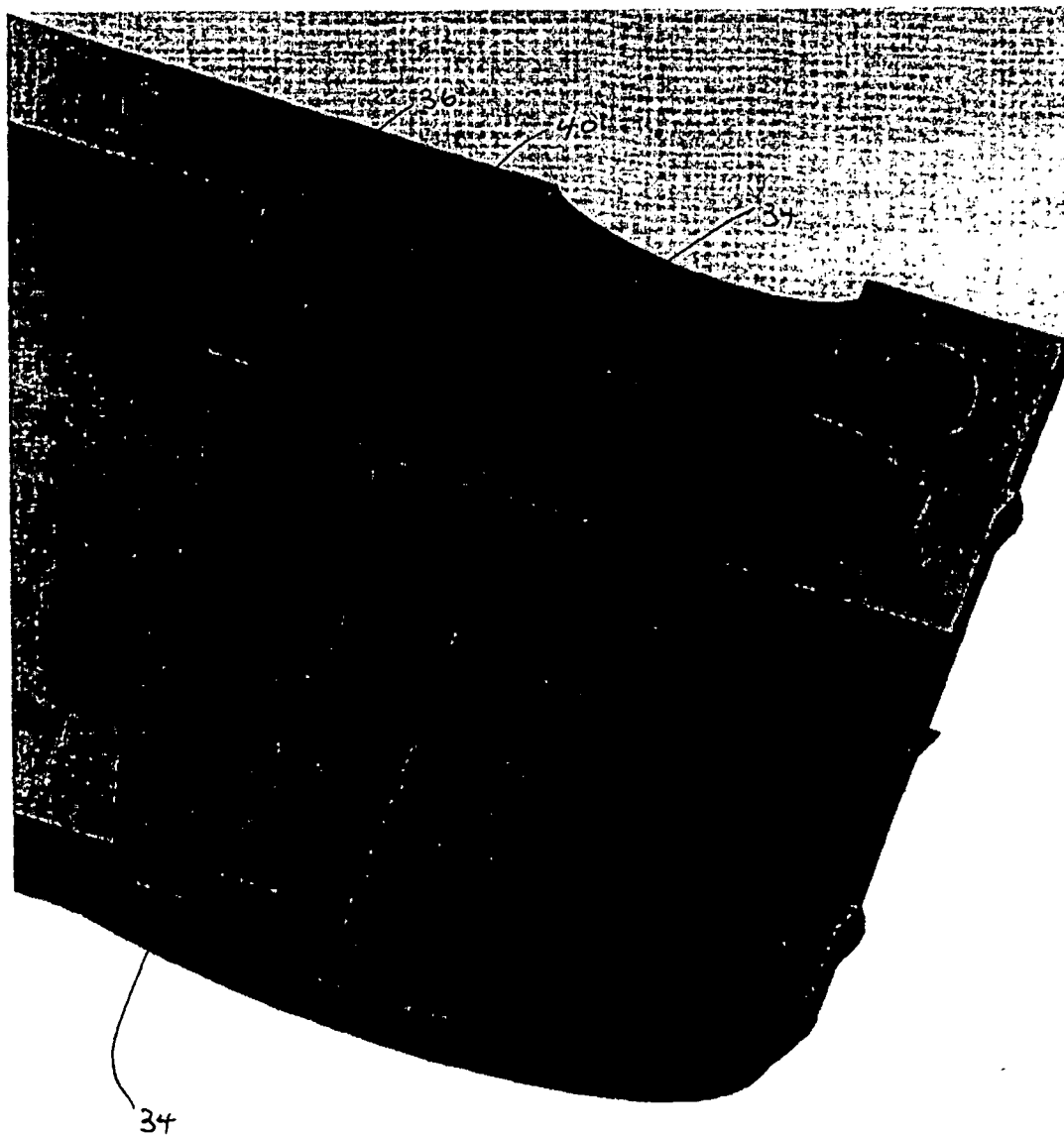


Figure 16

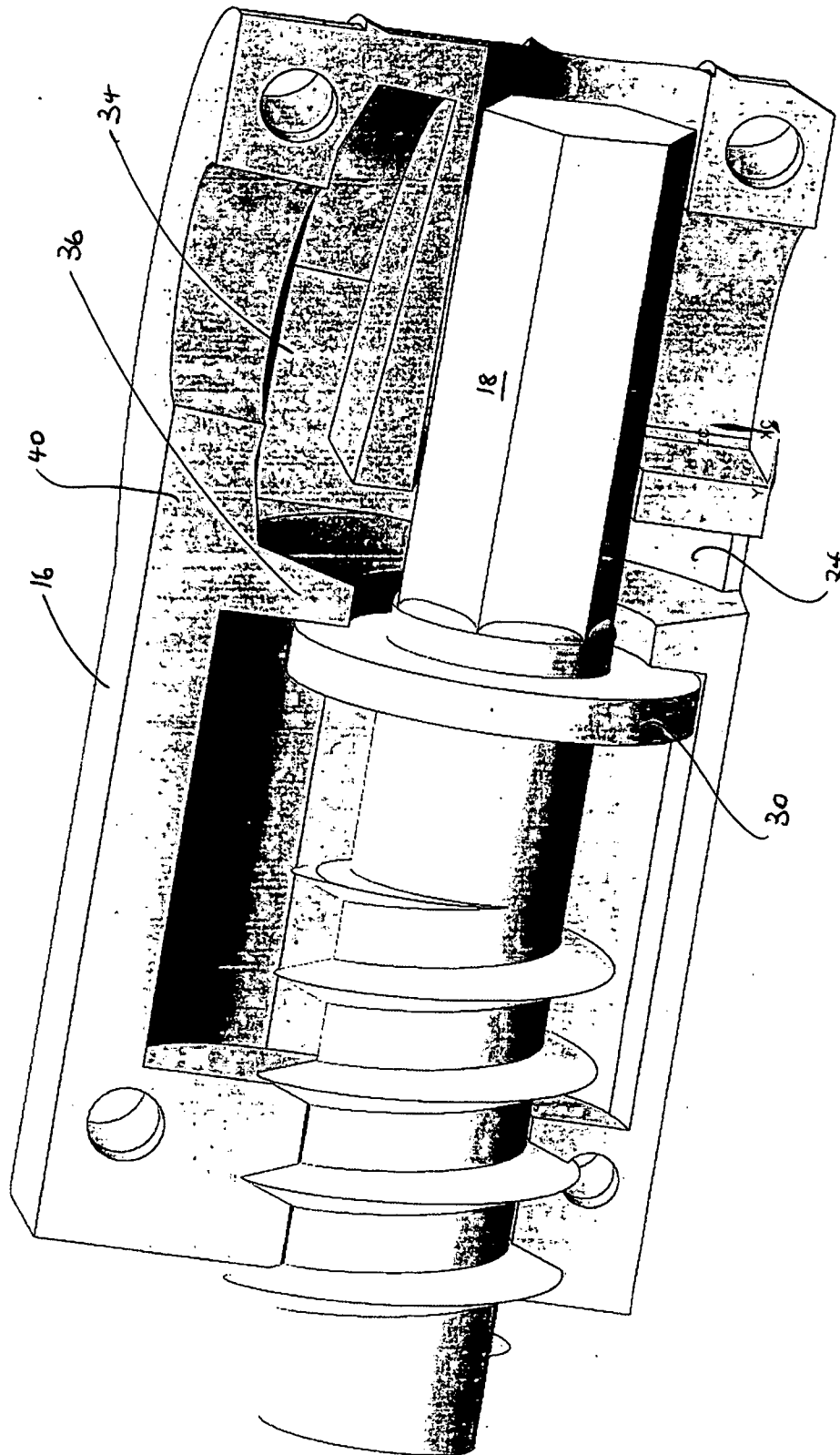


Figure 17
(Rule 26) RO/AU

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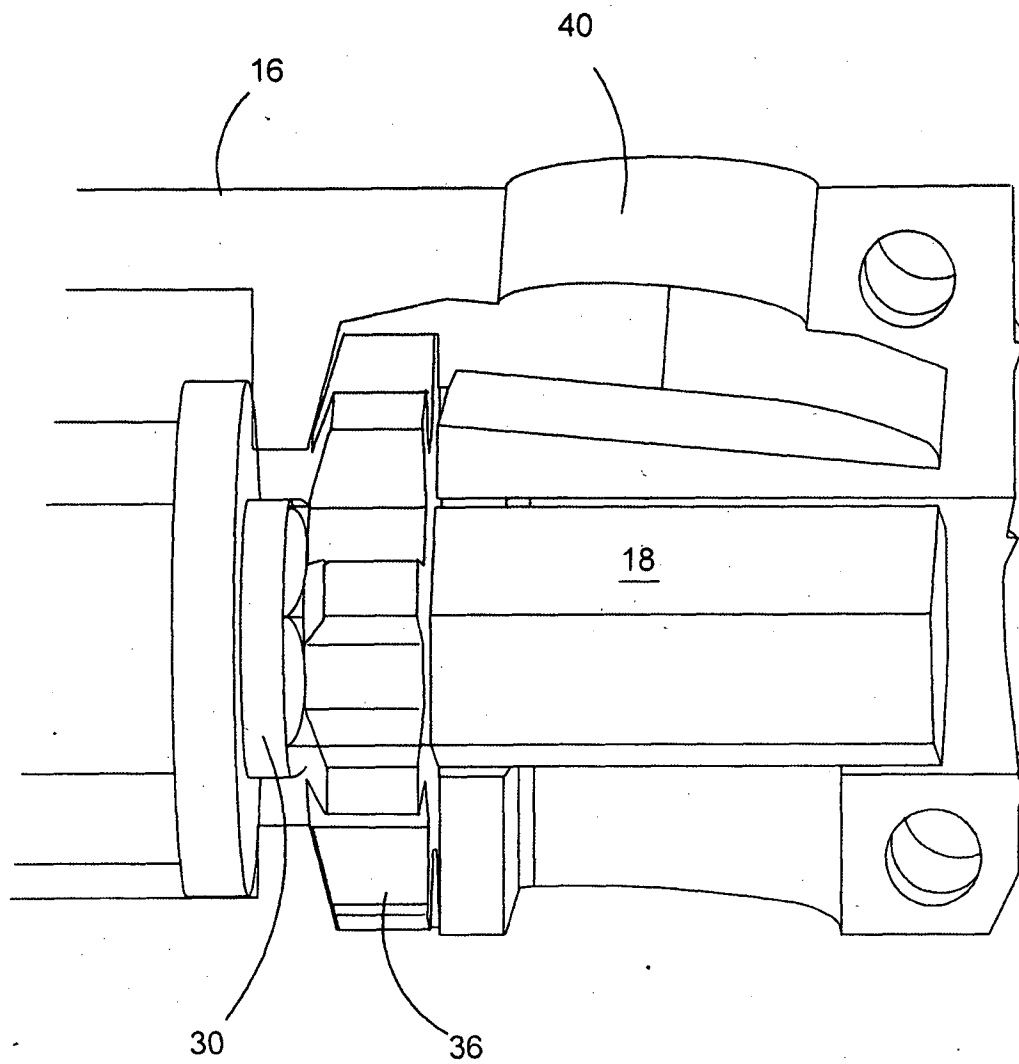


Figure 18

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2013/000692

A. CLASSIFICATION OF SUBJECT MATTER

F16B 12/14 (2006.01) F16B 12/20 (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: CPC - F16B5/02/LOW, F16B2012/10/LOW, F16B12/00/LOW and keywords (gear, bolt, thread, extend, slide and like terms)

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	



Further documents are listed in the continuation of Box C



See patent family annex

* "A"	Special categories of cited documents: document defining the general state of the art which is not considered to be of particular relevance	"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
"E"	earlier application or patent but published on or after the international filing date	"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
"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)	"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
"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 1 August 2013	Date of mailing of the international search report 01 August 2013
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaustalia.gov.au Facsimile No.: +61 2 6283 7999	Authorised officer Darcy Corbett AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. 0262832212

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:
2. ☒ Claims Nos.: **12**
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 C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		International application No. PCT/AU2013/000692
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2012/001452 A1 (BERNARDIN) 05 January 2012 Page 11 line 24 - page 12 line 4, Page 13 lines 13-25, Figs 1-5	1-11
X	JP 08-159121 A (SUGIURA TOSHIYASU) 18 June 1996 Abstract, Figures	1-4, 7, 11
A	EP 1793129 A1 (FERRAMENTA LIVENZA S.r.l.) 06 June 2007	

Supplemental Box

Continuation of **Box II**

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

INTERNATIONAL SEARCH REPORT Information on patent family members		International application No. PCT/AU2013/000692	
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
WO 2012/001452 A1	05 Jan 2012	CN 103180618 A	26 Jun 2013
		EP 2588764 A1	08 May 2013
		US 2013101342 A1	25 Apr 2013
		WO 2012001452 A1	05 Jan 2012
JP 08-159121 A	18 Jun 1996	None	
EP 1793129 A1	06 Jun 2007	None	
End of Annex			
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001. Form PCT/ISA/210 (Family Annex)(July 2009)			