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NOTICE

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1 Navy Case No. 77987

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ALIGNMENT LIFTING FIXTURE

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STATEMENT OF GOVERNMENT INTEREST

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The invention described herein may be manufactured and used
7 by or for the government of the United States of America for
8 governmental purposes without the payment of any royalties
9 thereon or therefor.

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11

BACKGROUND OF THE INVENTION

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(1) Field of the Invention

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This invention generally relates to a device for aligning
14 and lifting underwater objects.

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(2) Description of the Prior Art

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Earlier methods for aligning and lifting of underwater
17 objects were time consuming and difficult to engage.

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The following patents, for example, disclose aligning and/or
19 lifting devices, but do not disclose aligning in both vertical
20 and lateral directions in order to mate two halves of a heavy
21 object to lift the same.

22

U.S. Patent No. 3,045,785 to Ferguson

- 1 U.S. Patent No. 4,899,611 to Pinna
- 2 U.S. Patent No. 5,007,760 to Mullen et al.
- 3 U.S. Patent No. 5,085,535 to Solberg et al.
- 4 U.S. Patent No. 5,412, 913 to Daniels et al.

5 Specifically, the patent to Ferguson discloses a device for
6 connecting parts together, utilizing a side beam "A" and a bottom
7 ring segment "B". The side beam includes a tapered tongue 10
8 which is insertable into a mating slot or channel 12 of the
9 bottom ring segment. A captive taper pin 20 is inserted into
10 longitudinal apertures formed in each of the tapered tongue 10
11 and the bottom ring segment "B". This captive taper pin is in
12 effect the only aligning device used in the Ferguson patent and
13 must accomplish both vertical and lateral alignment. In other
14 words, it is necessary to use a specialized pin 20 and varying
15 sized apertures in the side beam and the bottom ring segment in
16 order to both vertically and horizontally align the two parts.

17 The patent to Pinna discloses a device for the correct
18 positioning of the lower steering shaft on the steering box
19 pinion and on the upper shaft, but does not utilize both vertical
20 and lateral alignment features.

21 Regarding the patent to Mullen et al., there is disclosed a
22 device for aligning and mounting a copier or printer subsystem.
23 The mounting and aligning, however, is only in a single

1 direction, with a memory feature to retain the obtained
2 alignment.

3 The patent to Solberg et al. discloses a locating mechanism
4 which has two mating surfaces cooperating for radial and axial
5 alignment to form on engagement an open-ended cylindrical body
6 having opposed cylindrical surfaces and opposed marginal
7 surfaces. The Solberg et al. device is unforgiving in that
8 simultaneous axial and radial alignment is required in order for
9 registry of opposing surfaces to occur. In an underwater
10 environment, such exactness is not possible.

11 The patent to Daniels et al. is directed to a self aligning
12 beam joint suited or use in modular construction and requires
13 exact manual vertical alignment in order to secure the upper and
14 lower columns together. Such an arrangement would be impossible
15 given the heavy weight of an underwater cage of the present
16 invention.

17 It should be understood that the present invention would in
18 fact enhance the functionality of the above patents.

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SUMMARY OF THE INVENTION

21 Therefore it is an object of this invention to provide an
22 alignment and lifting device which is an improvement over known
23 alignment devices found in the art.

1 Another object of this invention is to provide an alignment
2 and lifting device which mates an upper member with a lower
3 member in both vertical and lateral directions.

4 Still another object of this invention is to provide an
5 alignment and lifting device which enables lateral alignment of
6 the members.

7 A still further object of the invention is to provide an
8 alignment and lifting device which facilitates vertical or axial
9 alignment of the members.

10 Yet another object of this invention is to provide an
11 alignment and lifting device which is applicable to an underwater
12 unmanned swim out cage.

13 In accordance with one aspect of this invention, there is
14 provided an aligning and lifting device for an unmanned
15 underwater cage. The underwater cage includes a top portion and
16 a bottom portion. The aligning and lifting device includes a
17 male member having a support surface fixed to the top portion of
18 the cage, an integrally formed wedge shaped portion depending
19 from the support surface for lateral alignment capabilities, and
20 an alignment pin projecting from the distal end of the depending
21 wedge shaped portion for facilitating vertical alignment. The
22 female member includes integrally formed side walls and a support
23 surface opposed to the support surface of the male member,

1 thereby defining a complementary wedge shaped opening for
2 receiving the depending wedge portion of the male member, and an
3 alignment pin hole for receiving the alignment pin of the
4 depending wedge. The support surface of the female member is
5 fixed to the bottom portion of the cage. The male member is
6 aligned with the female member in a vertical direction by
7 insertion of the alignment pin into the alignment pin hole and in
8 a lateral direction by mating of the male wedge with the
9 complementary shaped female opening. Complete lateral and
10 vertical mating of the male member with the female member forms a
11 unitary block. Additionally, the male member is secured to the
12 female member upon mating thereof, and securing of the male
13 member to the female member correspondingly secures the top
14 portion of the cage to the bottom portion of the cage for unitary
15 lifting of the entire cage structure.

16 The present invention uses separate features to accomplish
17 each of the vertical and lateral alignments. The cost of the
18 present invention is also far less because it allows use of a
19 quick connect pin instead of a more expensive taper pin and the
20 apertures of the present invention are of a uniform diameter as
21 opposed to being varied. This can all be achieved by providing
22 the addition of a vertical alignment pin and corresponding
23 alignment pin hole as shown in the present invention. Therefore,

1 the present invention can in fact be considered a substantial
2 improvement over the prior art.

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4 BRIEF DESCRIPTION OF THE DRAWINGS

5 The appended claims particularly point out and distinctly
6 claim the subject matter of this invention. The various objects,
7 advantages and novel features of this invention will be more
8 fully apparent from a reading of the following detailed
9 description in conjunction with the accompanying drawings in
10 which like reference numerals refer to like parts, and in which:

11 FIG. 1 is a front perspective view of an underwater cage
12 utilizing the aligning device of the present invention; and

13 FIG. 2 is a front perspective view of an underwater cage
14 utilizing the aligning device of the present invention;

15 FIG. 2 is a front perspective and exploded view of the
16 lifting device shown in FIG. 1;

17 FIG. 3 is a bottom and side perspective and exploded view of
18 the lifting device shown in FIG. 1.

19

20 DESCRIPTION OF THE PREFERRED EMBODIMENT

21 Referring now to the figures, FIG. 1 illustrates a
22 perspective view of an unmanned underwater vehicle swim out cage
23 12 having an aligning and lifting device 10 applied thereto. The

1 cage 12 is shown without the vehicle for the sake of clarity.
2 There are two primary parts to the underwater cage 12, including
3 a top half 14 and a bottom half 16 of the cage 12. When lifting
4 or moving the cage 12, it is necessary to align the top half 14
5 with the bottom half 16 thereof.

6 As shown in greater detail in FIGs. 2, 3 and 4, the aligning
7 and lifting device 10 is used to align the top half 14 with the
8 bottom half 16 of the cage. In general, the aligning and lifting
9 device 10 includes two stainless steel blocks and two quick
10 release pins which align and lift the two halves of the unmanned
11 underwater vehicle swim out cage with the vehicle in the cage.
12 More specifically, the alignment and lifting device 10 includes
13 an upper portion 18 and a lower portion 32. The upper portion 18
14 includes a primary block member 20 and a wedge shaped portion 22
15 depending from the primary block member 20. As shown, and for
16 purposes of reference, the upper portion 18 of the alignment and
17 lifting device 10 has facing walls 28 and end walls 30. The end
18 walls 30 are oriented substantially perpendicularly to the facing
19 walls 28. At least a pair of wedge apertures 24 are formed in
20 the wedge shaped portion 22 of the alignment and lifting device
21 10. More specifically, the wedge apertures 24 are formed in a
22 wall of the wedge portion corresponding to the end walls 30, and
23 are thus perpendicular to the facing walls 28. Each of the wedge

1 apertures 24 is formed through the entirety of the wedge portion
2 22.

3 An axial alignment pin 26 is formed to depend from a
4 terminal end of the wedge shaped portion 22 as shown. It is
5 intended that the term axial refer to what is the vertical
6 orientation of the device 10. The axial alignment pin 26 in
7 combination with the axial alignment pin hole 50 accounts for the
8 vertical mating of the upper 14 and lower 16 cage portions with
9 each other.

10 The lower portion 32 of the alignment and lifting device 10
11 includes a U-shaped body member 36 having a wedge receiving
12 portion 34 defined thereby which is shaped to conform to and
13 snugly receive the wedge portion 22. The U-shaped body member 36
14 includes a facing wall 46 and end walls 48. Upon mating of the
15 upper portion 18 and the lower portion 20, it will be appreciated
16 that the alignment and lifting device appears as simple block
17 shape. At least a pair of longitudinal apertures 38 are formed
18 in the facing walls 46 of the U-shaped body member 36. These
19 longitudinal apertures 38 are aligned with the longitudinal wedge
20 apertures 24 of the upper portion 18 upon mating of the upper 18
21 and lower 32 portions of the alignment and lifting device. An
22 axial alignment pin hole 50 is formed in the base of the wedge

1 receiving portion 34 of the U-shaped body member 36 and is
2 complementary in shape to the axial alignment pin 26.

3 Upon joining of the upper portion 18 with the lower portion
4 32 of the alignment and lifting device 10, the wedge apertures 22
5 will be precisely aligned with the longitudinal apertures 38 in
6 the U-shaped body member 36. This precise alignment is due to
7 the complementary mating shapes of the wedge portion 22 with the
8 wedge receiving portion 34. In other words, the complementary
9 shapes of these two members permits only one longitudinal mating
10 possibility. With the axial (vertical) alignment being accounted
11 for by the mating of the axial alignment pin 26 with the axial
12 alignment pin hole 50 and the lateral alignment accounted for by
13 the wedge matching, both the vertical and lateral positioning of
14 the upper 18 and lower 32 portions are virtually self-aligning.

15 In order to secure the upper 18 and lower 32 portions of the
16 alignment and lifting device 10 together, at least a pair of
17 longitudinal quick release pins 40 are inserted into the aligned
18 openings of the wedge apertures 24 and the longitudinal apertures
19 38 in the U-shaped portion 36. Each longitudinal alignment pin
20 40 includes a shaft or shank portion 42 and a head portion 44 as
21 shown. Since the apertures 24 and 38 are on a common axis, the
22 insertion of the longitudinal alignment pins 40 is a simple
23 matter.

1 Each of the upper portion 18 and the lower portion 32 of the
2 alignment lifting device 10 is secured to the top half 14 and
3 bottom half 16, respectively, of the swim out cage 12 at a
4 plurality of locations on the cage 12. The securing may be by
5 any suitable means such as, for example, welding or bolting. In
6 some instances, it may be possible for the upper 18 and lower 32
7 portions of the alignment and lifting device to be integrally
8 formed with the respective parts of the cage 12 during the cage
9 forming process. In any event, it should be understood that the
10 securing means will be suitable to the weight of the cage with a
11 vehicle in the cage 12, so that lifting of the cage will not
12 cause separation of the alignment and lifting device 10 from the
13 cage 12. As shown in FIG. 1 there are 14 alignment and lifting
14 devices 10 shown to be periodically spaced around the cage 12.
15 The number of alignment and lifting devices used is not
16 significant except that they should be sufficient in number to
17 adequately support the load within the cage 12 and to evenly
18 secure the top part 14 of the cage to the bottom part 16 of the
19 cage.

20 With regard to the use of the wedge shaped portion 22 and
21 its complementary wedge receiving portion 34, it should be
22 understood that this arrangement was selected for the unique
23 ability to align in both the axial and lateral directions when

1 mating the top part 14 of the cage 12 to the bottom part 16 of
2 the cage 12. However, it may be found that other shapes are
3 suitable for the dual axis positioning of large objects, and the
4 present invention is intended to encompass those shapes as well.
5 Similarly, although the use of pair of apertures 22, 38 and pins
6 40 are shown, any number of apertures and corresponding number of
7 pins may be found to be suitable. Further, although a simple
8 straight pin 40 is shown, any type of quick disconnect pin would
9 be suitable which will slide through the common axis of the
10 apertures.

11 By the present invention, the aligning and lifting of a
12 heavy object such as a swim out cage 12 is conducted in a timely
13 and more efficient manner than previously achieved in the art.
14 The entirety of the inventive alignment and lifting device 10
15 when assembled as a block is 3 ½ inches wide by 4 inches long and
16 3 ½ inches high and made out of stainless steel. The pins 40 are
17 .500 diameter stainless steel, but also may be made of any other
18 suitable material.

19 The invention shown has been sized for a particular
20 application of aligning cage parts that are 25 feet long and 3
21 feet high, with a loaded weight of 20,000 pounds. Accordingly,
22 and as previously mentioned, varying the size of the blocks or
23 the pins can be done for different applications. Likewise, the

1 design may be further modified by changing the composition of the
2 materials used or by changing the number of alignment and lifting
3 blocks used. It should also be appreciated that the disclosed
4 alignment and lifting blocks 10, while being shown for use in a
5 heavy unmanned water vehicle swim out cage 12, may be used for
6 aligning and lifting virtually any heavy, two part, symmetrical
7 object, either on land or under water.

8 This invention has been disclosed in terms of certain
9 embodiments. It will be apparent that many modifications can be
10 made to the disclosed apparatus without departing from the
11 invention. Therefore, it is the intent to
12 cover all such variations and modifications as come within the
13 true spirit and scope of this invention.

1 Navy Case No. 77987

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ALIGNMENT LIFTING FIXTURE

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ABSTRACT OF THE DISCLOSURE

6 An aligning and lifting device is disclosed. The invention
7 may be for use with an underwater cage including a top portion
8 and a bottom portion. The aligning and lifting device includes a
9 male member having a support surface fixed to the top portion of
10 the cage, an integrally formed wedge shaped portion depending
11 from the support surface for lateral alignment capabilities, and
12 an alignment pin projecting from the distal end of the depending
13 wedge shaped portion for facilitating vertical alignment. The
14 device also has a female member that includes integrally formed
15 side walls and complementary support surfaces opposed to the
16 support surface of the male member, thereby defining a
17 complementary wedge shaped opening for receiving the depending
18 wedge portion of the male member. An alignment pin hole is formed
19 at the base of said complementary wedge shaped opening for
20 receiving the alignment pin of the depending wedge. The male
21 member is aligned with the female member in a vertical direction
22 by insertion of the alignment pin into the alignment pin hole and

1 in a lateral direction by mating of the male wedge with the
2 complementary shaped female opening.

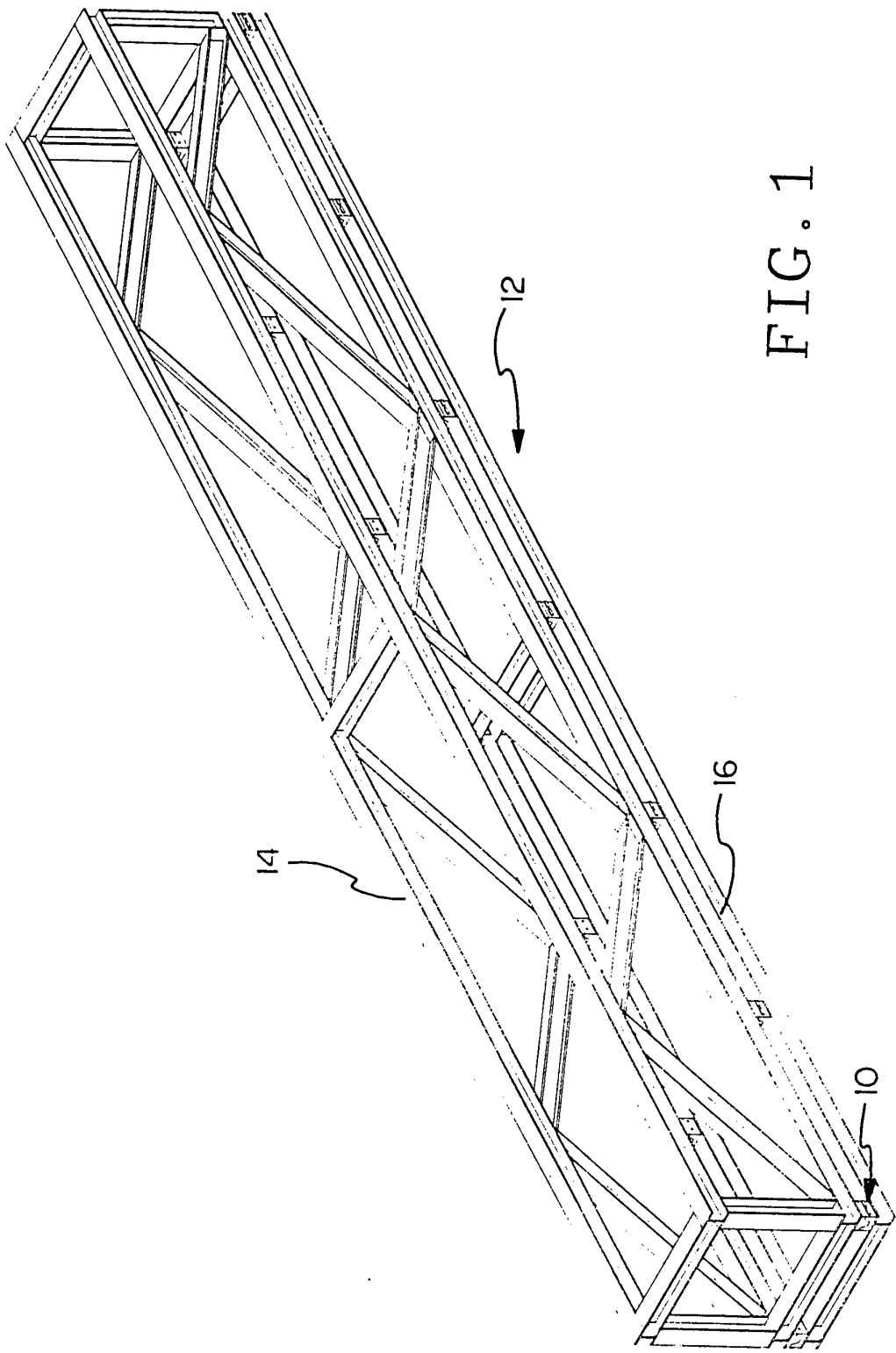


FIG. 1

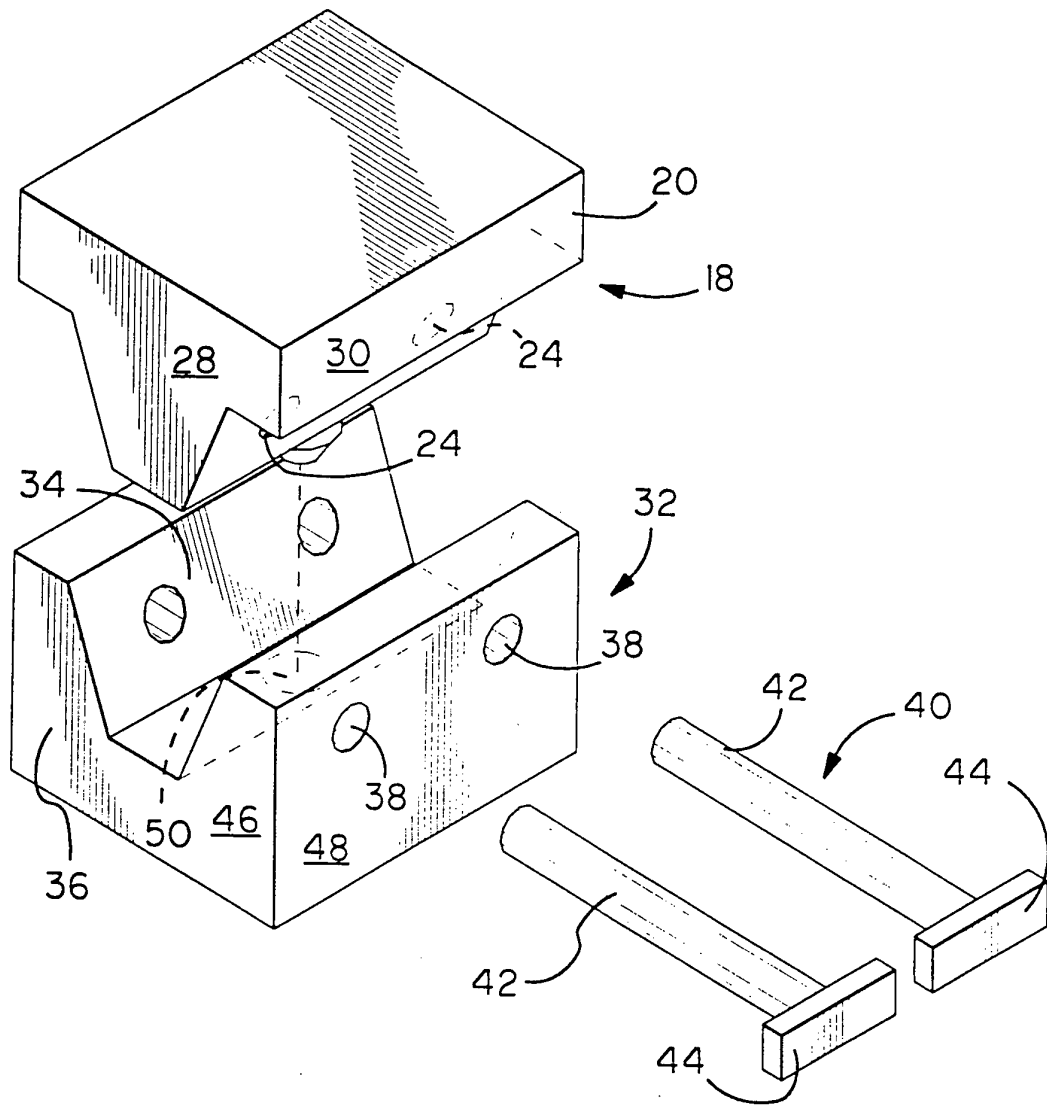


Fig. 2

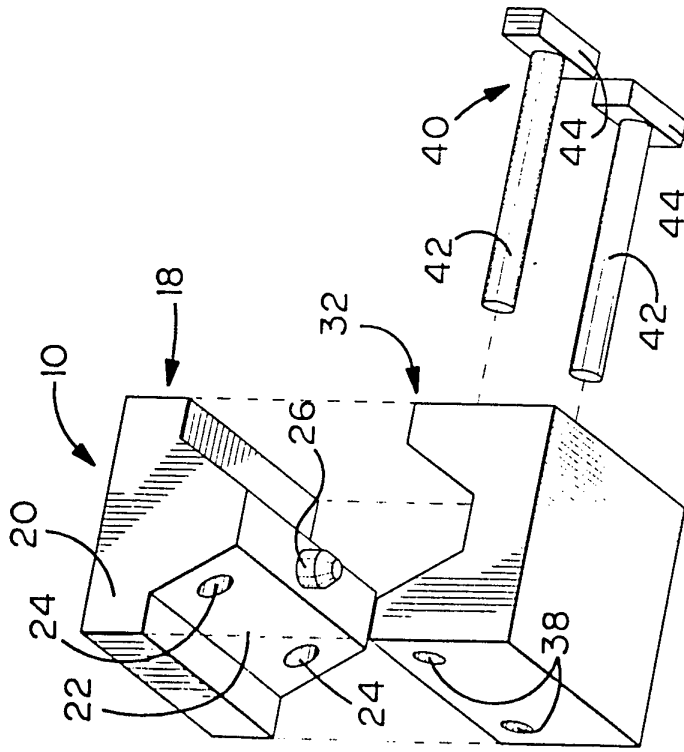


FIG. 3

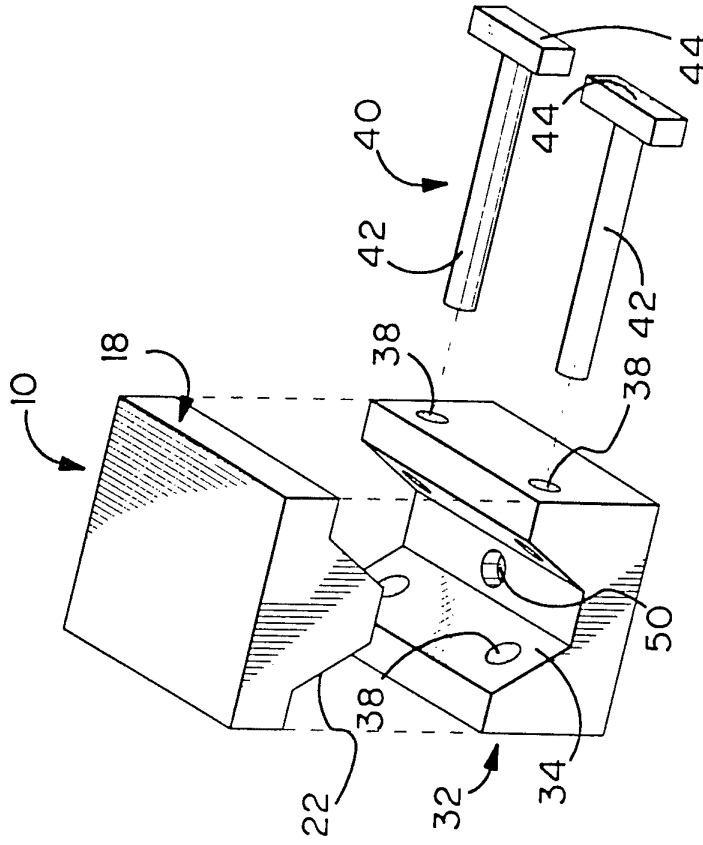


FIG. 4