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Inventor Robert Meunier

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2
3 CONFIGURABLE PORT ASSEMBLY

4
5 STATEMENT OF GOVERNMENT INTEREST

6 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 therefore.

10
11 BACKGROUND OF THE INVENTION

12 (1) Field of the Invention

13 This invention relates to ports for water tunnels and in
14 particular, to a configurable port assembly.

15 (2) Description of the Prior Art

16 Measuring and testing a flowing fluid or other medium
17 flowing in a tunnel or similar structure is often necessary, for
18 example, by inserting a flow measuring device into the flowing
19 fluid, by injecting a substance into the flowing fluid, or by
20 ejecting or extracting the flowing fluid from the tunnel.

21 In water tunnels and other similar structures containing a
22 flowing fluid or medium, one may need access to the fluid flowing
23 within the tunnel or similar structure without allowing the
24 flowing fluid to escape from the tunnel. Water tunnels and other
25 similar structures typically have a receptacle in a wall of the
26 tunnel to receive devices that interact with the flowing fluid,

1 e.g., by measuring the flow or by injecting a flowing fluid into
2 the fluid stream.

3 A block having a port, such as an ejector block, positioned
4 in the receptacle in the water tunnel or similar structure is one
5 way in which one can access the flowing fluid to measure fluid
6 flow or inject flowing fluid into the tunnel. Prior art blocks
7 having ports comprise a solid block of material having a slot
8 extending through the block of material forming a shaped port.
9 In some cases, the slot is milled in the solid block of material.
10 In other cases, where the desired shape of the port cannot be
11 achieved by milling a slot, a casting is made.

12 Such prior art blocks comprised of a single solid block of
13 material are of limited usage in that the block provides only one
14 shape for the port or slot. To provide a number of different
15 shapes of ports requires a plurality of solid blocks with a
16 different shaped port or slot formed in each block. The milling
17 process, however, is limited in the types of shapes that can be
18 formed. The casting process can make a wider variety of shapes
19 but is unnecessarily expensive. Thus, manufacturing prior art
20 blocks with ports or slots of varying shapes has involved a
21 significant amount of material and time as well as a complex and
22 expensive process.

23 24 SUMMARY OF THE INVENTION

25 Accordingly, one object of the present invention is to
26 provide a configurable port assembly that can be assembled into a

1 variety of configurations having ports or slots with different
2 shapes. Another object of the present invention is to provide a
3 port assembly which can be easily and inexpensively fabricated
4 with conventional machining processes. A still further object is
5 to provide a port assembly which can easily be reconfigured
6 without the use of special tools.

7 These objects are accomplished with the present invention by
8 providing a configurable port assembly for use in a structure
9 containing a medium, such as a flowing fluid. The configurable
10 port assembly includes at least two configurable port assembly
11 components assembled in at least one predetermined configuration.
12 The configurable port assembly components, when assembled in the
13 predetermined configuration, form a first opening in a first side
14 of the configurable port assembly and a second opening in a
15 second side of the configurable port assembly. A configurable
16 port or slot having at least one predefined shape extends from
17 the first opening to the second opening and is defined by the
18 configurable port assembly components.

19 The configurable port assembly components are adapted to be
20 assembled in a plurality of predetermined configurations to form
21 configurable ports or slots having a plurality of predefined
22 shapes. Each configurable port assembly component includes a
23 shaped surface that forms a portion of the configurable port.
24 Unlike machining or casting a slotted opening in a port
25 comprising a solid block, the shaped surfaces of the port

1 assembly components are easily machined to the desired
2 configuration.

3 The shaped surface of at least one of the configurable port
4 assembly components is adapted to form a configurable port having
5 a first predefined shape when the configurable port assembly
6 component is assembled in a first assembled position and is
7 adapted to form configurable port having a second predefined
8 shape when assembled in a second assembled position. Thus, the
9 configurable port assembly according to the present invention
10 can be configured to form ports or slots having various shapes
11 and thus improves versatility.

12 In the preferred embodiment, the configurable port assembly
13 includes at least four configurable port assembly components
14 assembled in at least one predetermined configuration. Each of
15 the four configurable port assembly components includes at least
16 one shaped surface defining a portion of the configurable port.
17 At least two of the four configurable port assembly components
18 can be assembled in first and second assembled positions to form
19 configurable ports having a plurality of predefined shapes.

20 Each configurable port assembly component includes at least
21 one port assembly component engaging surface, for engaging with
22 at least one other configurable port assembly component. The
23 configurable port assembly components preferably include at least
24 one coupling member engaging portion, for engaging a coupling
25 member and securing the configurable port assembly component to
26 other configurable port assembly components.

1 In the preferred embodiment, the coupling members include
2 pin coupling members, and the coupling member engaging portion
3 includes a hole, for receiving a pin coupling member and securing
4 the configurable port assembly components together in an
5 assembled position. Thus, the configurable port assembly
6 components can easily be assembled and coupled without tools into
7 a plurality of predetermined configurations to form ports or
8 slots of various shapes.

9 10 BRIEF DESCRIPTION OF THE DRAWINGS

11 These and other features and advantages of the present
12 invention will be better understood in view of the following
13 description of the invention taken together with the drawings
14 wherein corresponding reference characters indicate corresponding
15 parts throughout the several views of the drawings and wherein:

16 FIG. 1 is a cross-sectional view of a configurable assembly,
17 according to the present invention, positioned in a receptacle of
18 a flowing fluid containing structure;

19 FIG. 2 is a perspective view of a configurable port assembly
20 assembled in a predetermined configuration according to one
21 embodiment of the present invention;

22 FIG. 3 is a perspective view of a configurable port assembly
23 comprising configurable port assembly components in a
24 disassembled condition according to the present invention;

25 FIGS. 4A-4F are cross-sectional views of configurable ports
26 having various shapes formed by a first and second configurable

1 port assembly component according to various embodiments of the
2 present invention; and

3 FIGS. 5A-5F are cross-sectional views of configurable ports
4 having various shapes defined by third and fourth configurable
5 port assembly components according to various embodiments of the
6 present invention.

7 8 DESCRIPTION OF THE PREFERRED EMBODIMENT

9 Referring to FIG. 1, a configurable port assembly 20,
10 according to the present invention, is used in a structure 10,
11 such as a tunnel, containing a medium 14, such as flowing fluid.
12 For example, the configurable port assembly 20 can be positioned
13 in a receptacle 11 disposed in a wall 12 of the structure 10.
14 Typically, the configurable port assembly 20 is used in a
15 structure 10 containing a flowing fluid 14.

16 The configurable port assembly 20 has a first or top side 21
17 and second or bottom side 23 and includes at least two
18 configurable port assembly components 22a, 22b. The configurable
19 port assembly components 22a, 22b form a configurable port or
20 slot 28 having a first opening 24 proximate the first side 21 and
21 a second opening 26 proximate the second side 23. The
22 configurable port assembly components 22a, 22b each include at
23 least one shaped surface 30a, 30b and once assembled in a
24 predetermined configuration, form the configurable port or slot
25 28 having a predefined shape. The configurable port assembly
26 components 22a, 22b are also adapted to be assembled in other

1 predetermined configurations to form a configurable port assembly
2 port or slot 28 having other predefined shapes, as will be
3 described in greater detail below.

4 In one example, the configurable port assembly 20 is used to
5 inject a substance, such as a liquid, into the flowing fluid or
6 other medium 14. In this example, a conduit 16 conveys the
7 flowing fluid to the configurable port assembly 20. The conduit
8 16 is fluidly coupled to a cover 18 which is coupled to the
9 structure 10. The cover 18 is positioned over the configurable
10 port assembly 20 and preferably is shaped to retain the
11 configurable port assembly 20 in the receptacle 11. The cover 18
12 also preferably includes one or more seals 19, for sealing the
13 cover 18 to the structure 10 and preventing flowing fluid from
14 escaping.

15 In this example, the first opening 24 in port 28 acts as an
16 inlet allowing a flowing fluid or other substance from the
17 conduit 16 (which is coupled to a fluid source, not shown) to
18 enter the configurable port or slot 28. The second opening 26
19 acts as an outlet allowing the fluid or substance to be injected
20 into the flowing fluid 14 contained in or flowing past the
21 structure 10. If the flowing fluid 14 is flowing in the
22 direction indicated by arrows 13, the second opening or outlet 26
23 is preferably designed so that flowing fluid can be injected into
24 the structure 10 without the flowing fluid 14 escaping through
25 the configurable port or slot 28.

1 In addition to being used for injection or infusion of a
2 fluid or substance, the present invention contemplates using the
3 configurable port 28 for ejection or removal of a medium or
4 substance, such as fluid, from the structure 10 and for measuring
5 or testing a condition of the medium contained in the structure,
6 such as flow rate, temperature, and chemical composition.

7 Referring now to FIG. 2, a preferred embodiment is shown
8 wherein the configurable port assembly 20 includes four
9 configurable port assembly components 22a-22d assembled in at
10 least one predetermined configuration to form the configurable
11 port slot 28. The assembled configurable port assembly
12 components 22a-22d preferably form an outer shape, such as a
13 block shape, adapted to fit in receptacle 11 of FIG 1.

14 The four configurable port assembly components 22a-22d are
15 preferably coupled together in the assembled condition with
16 coupling members 29. The preferred coupling members 29 include
17 pin coupling members, such as dowel pins, extending through the
18 four configurable port assembly components 22a-22d, as will be
19 described in greater detail below.

20 Each configurable port assembly component 22a-22d includes
21 one or more shaped surfaces 30a-30d. The shaped surfaces 30a-
22 30d, one such shaped surface on each respective configurable port
23 assembly component 22a-22d, cooperate to form, when assembled,
24 the configurable port 28. First and second configurable port
25 assembly components 22a, 22b are assembled with shaped surfaces
26 30a, 30b opposite one another to form corresponding sides of the

1 configurable port 28. Third and fourth configurable port
2 assembly components 22c, 22d are assembled with shaped surfaces
3 30c, 30d opposite one another, forming their respective
4 corresponding sides of the configurable port 28.

5 Referring now to FIG. 3, there is shown an exploded view of
6 the port assembly of FIG. 2. At least a first configurable port
7 assembly component 22a includes a shaped surface 30a. The first
8 configurable port assembly component 22a can be assembled in a
9 first and second assembled position to vary the shape of the
10 configurable port 28. In the first assembled position,
11 corresponding to the cross-section of FIG. 1, the first or top
12 portion 21 is proximate the first opening 24 (shown in FIG. 1)
13 and the second or bottom portion 23 is proximate the second
14 opening 26 (also shown in FIG. 1). In the second assembled
15 position (not shown), the first configurable port assembly
16 component 22a is rotated 180 degrees so that the second portion
17 23 is proximate the first opening 24 and the first portion 21 is
18 proximate the second opening 26.

19 In the preferred embodiment, a second configurable port
20 assembly component 22b also includes a shaped surface 30b. The
21 present invention contemplates rotating the second configurable
22 port assembly 22b in the same way (180 degrees) as the first
23 configurable port assembly component 22a from a first position to
24 a second position to further vary the shape of the configurable
25 port or slot 28. Thus, the configurable port assembly components

1 22a-22d provide multiple configurations defining a configurable
2 port or slot 28 having multiple shapes.

3 Each of the configurable port assembly components 22a-22d
4 include a port assembly component engaging surface 36a-36d, for
5 engaging with another configurable port assembly component when
6 assembled. In the preferred embodiment, the shaped surfaces 36c,
7 36d of the third and fourth configurable port assembly components
8 22c, 22d correspond to shaped surfaces 30c and 30d. Surfaces 36c
9 and 36d engage and preferably match the shape of the port
10 assembly component engaging surfaces 36a, 36b of the first and
11 second configurable port assembly components 22a, 22b.

12 In the preferred embodiment, each configurable port assembly
13 component 22a-22d includes at least one coupling member engaging
14 region 39, such as a hole extending through the configurable port
15 assembly components 22a-22d. Pin coupling members 29, such as
16 dowel pins, extend through holes 39 in the configurable port
17 assembly components 22a-22d to couple the configurable port
18 assembly components 22a-22d in the assembled condition. The
19 regions 39 in each configurable port assembly component 22a-22d
20 are aligned to receive the pin coupling members 29 when the
21 configurable port assembly components 22a-22d are assembled.
22 Thus, the configurable port assembly components 22a-22d can
23 easily be assembled without requiring tools.

24 Each configurable port assembly component 22a-22d is formed
25 using conventional machining processes. The configurable port
26 assembly components 22a-22d are machined from a material suitable

1 to the flowing fluid environment in which the configurable port
2 assembly 20 is used. For example, any suitable metal, plastic or
3 other material may be used.

4 Referring now to FIGS. 4A-4F, the first and second
5 configurable port assembly components 22a, 22b are assembled so
6 that the shaped surfaces 30a, 30b (indicated in FIG. 4A) are
7 facing one another and the shaped surfaces 30a, 30b define a
8 shaped thickness of the configurable port 28.

9 A plurality of different shaped thicknesses of the
10 configurable ports or slots 28 can be formed by machining various
11 shaped surfaces, such as curved surfaces, in first and second
12 configurable port assembly components 22a, 22b. The present
13 invention also contemplates linear shapes as well as curves for
14 the shaped surfaces on first and second configurable port
15 assembly components 22a, 22b.

16 In one embodiment, FIG. 4F, a fifth configurable port
17 assembly component 22e can be provided to form two configurable
18 ports or slots 28a, 28b. The fifth configurable port assembly
19 component 22e includes at least two shaped surfaces 30e, 38e that
20 form a portion of each configurable port 28a, 28b. The fifth
21 configurable port assembly component 22e can also be assembled in
22 first and second assembled positions in the same way as the first
23 and second configurable port assembly components 22a, 22b. The
24 present invention contemplates additional configurable port
25 assembly components to form any desired number of configurable
26 ports in the configurable port assembly.

1 Referring now to FIGS. 5A-5F, the third and fourth
2 configurable port assembly components 22c, 22d are assembled so
3 that shaped surfaces 30c, 30d (indicated in FIG. 5A) are facing
4 one another to define a shaped width of the configurable port 28.
5 A plurality of shaped widths of the configurable ports or slots
6 28 can be provided by machining various shaped surfaces on the
7 third and fourth configurable port assembly components 22c, 22d.
8 The present invention contemplates curved shapes as well as
9 linear shapes for the shaped surface on third and fourth
10 configurable port assembly components 22c, 22d.

11 Accordingly, the configurable port assembly according to the
12 present invention provides a port assembly that is easily and
13 relatively inexpensively fabricated with conventional machining
14 processes. The configurable port assembly can also be assembled
15 and disassembled without tools to form a wide variety of port or
16 slot configurations. The preferred embodiment comprises four
17 components which mate and engage to form the port assembly. A
18 series of pins hold the components together. When assembled, the
19 components fit within a receptacle in a tunnel or similar
20 structure through which a fluid is flowing. The components have
21 shaped surfaces which form the sides of a port or slot through
22 the assembly, such that instruments may be inserted through the
23 port into the fluid, a second fluid may be injected into the
24 fluid stream through the port, or a portion of the fluid stream
25 may be extracted through the port.

1 Obviously, many modifications and variations of the present
2 invention may become apparent in light of the above teachings.
3 In addition to varying the shaped surfaces to change the shape of
4 the port, the outside shape of the assembly may be varied to suit
5 the receptacle or the fluid stream. Depending on the purpose of
6 the port, the shape of surfaces in contact with the fluid may be
7 varied to provide a range of flow conditions from laminar to
8 turbulent in the vicinity of the port. As previously indicated,
9 the material from which the assembly components are fabricated
10 may be varied to suit the fluid flow and test requirements.

11 In light of the above, it is therefore understood that
12 the invention may be
13 practiced otherwise than as specifically described.

1 Navy Case 76570

2 CONFIGURABLE PORT ASSEMBLY

3
4 ABSTRACT OF THE DISCLOSURE

5 A configurable port assembly is used proximate a medium
6 containing structure, such as a water tunnel, e.g. to measure
7 fluid flow or inject flowing fluid into the tunnel. The
8 configurable port assembly includes at least two configurable
9 port assembly components assembled to define a configurable port
10 extending from a first opening to a second opening. One or more
11 of the configurable port assembly components can be rotated from
12 a first to a second assembled position to define a configurable
13 port having at least two predefined shapes. The configurable port
14 assembly preferably includes four configurable port assembly
15 components assembled and coupled together with coupling members,
16 such as dowel pins, extending through the components. Two of the
17 configurable port assembly components have shaped surfaces that
18 define a shaped thickness of the configurable port while the
19 other two components have shaped surfaces that define a shaped
20 width of the port. Various shapes can be machined in the
21 configurable port assembly components to provide numerous
22 variations of the configurable port.

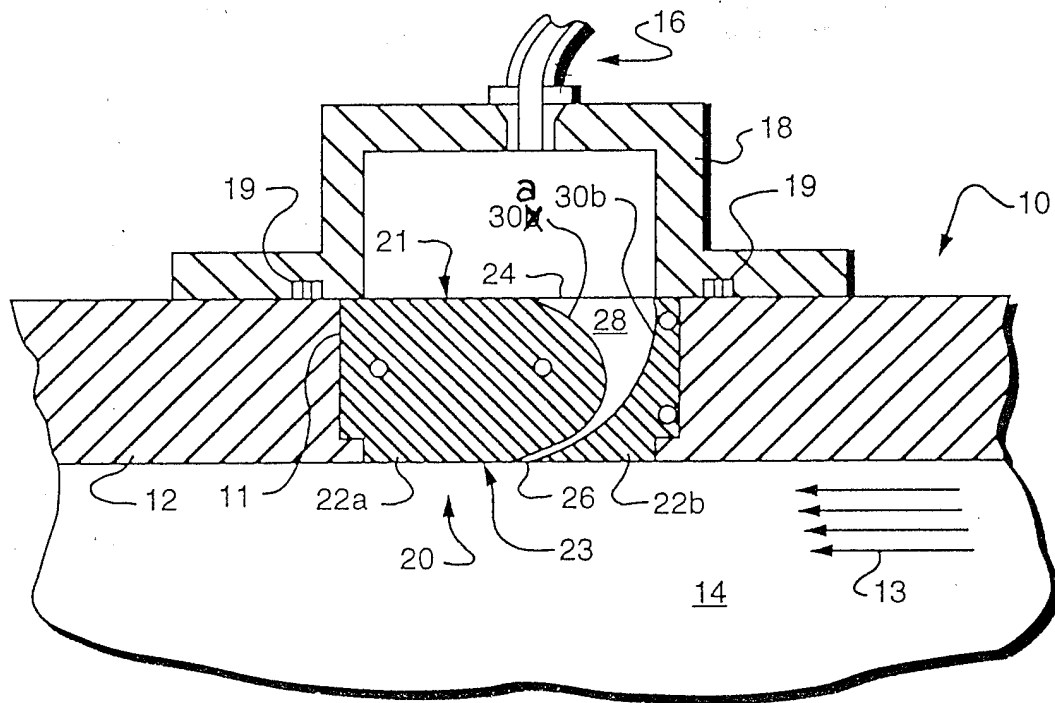


FIG. 1

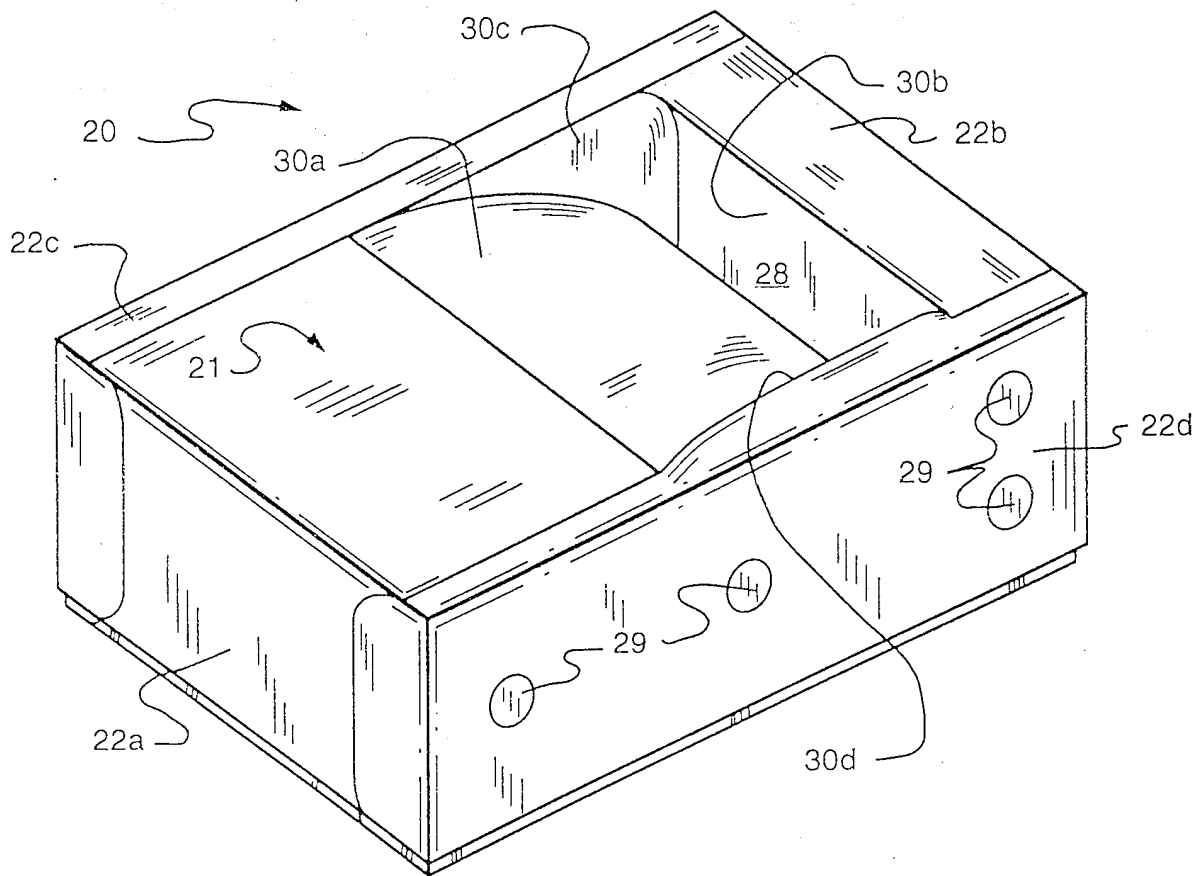
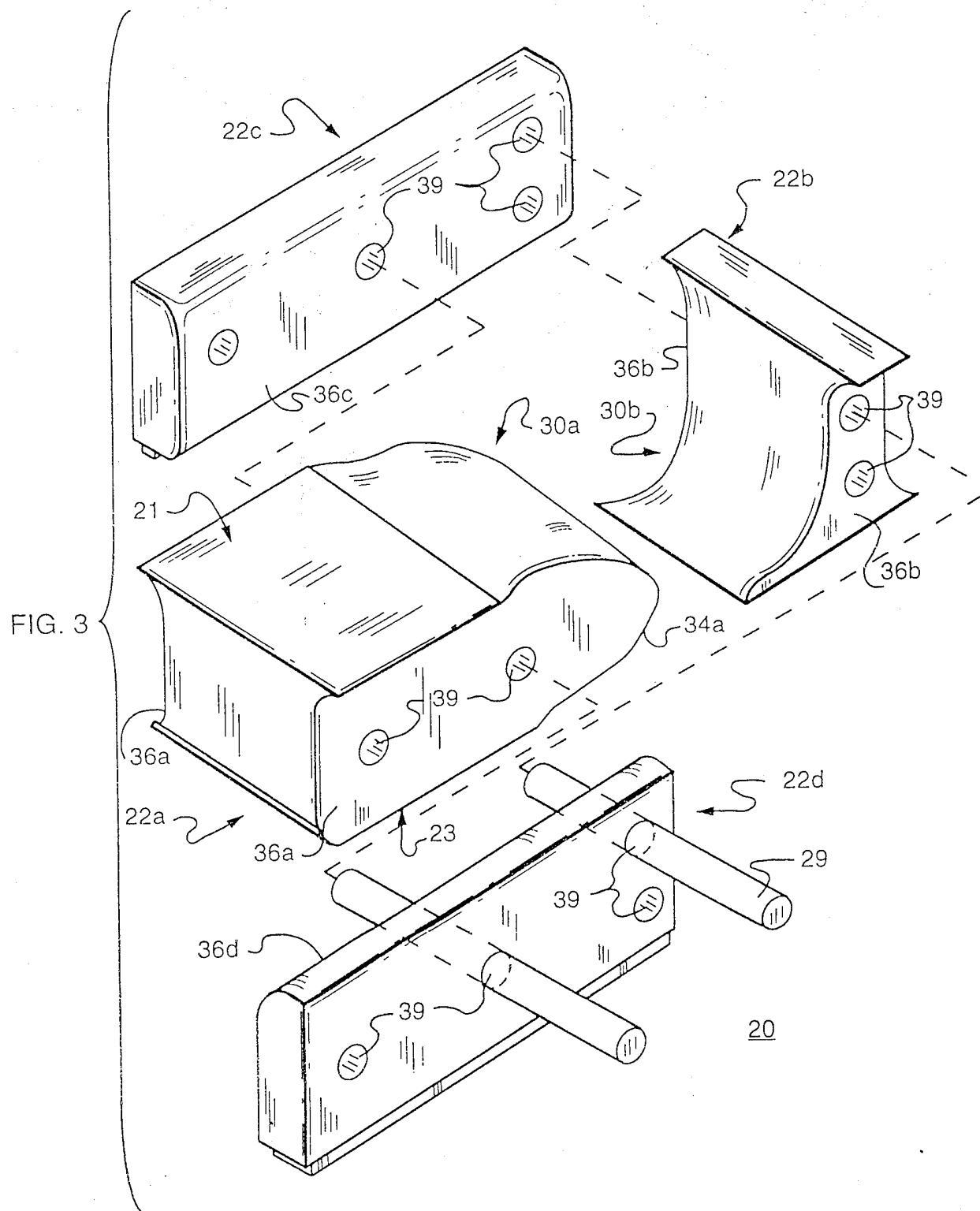


FIG. 2



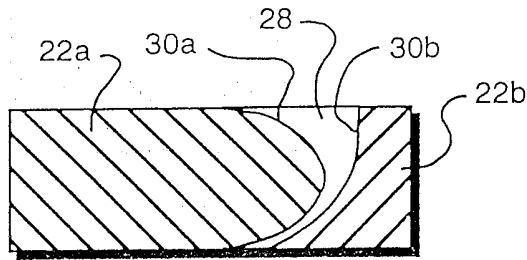


FIG. 4A

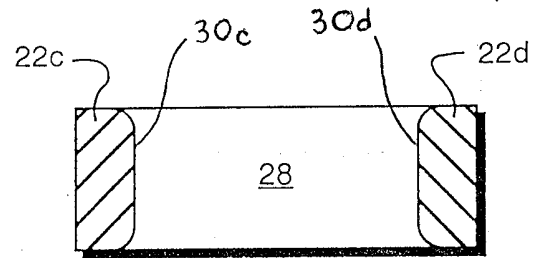


FIG. 5A

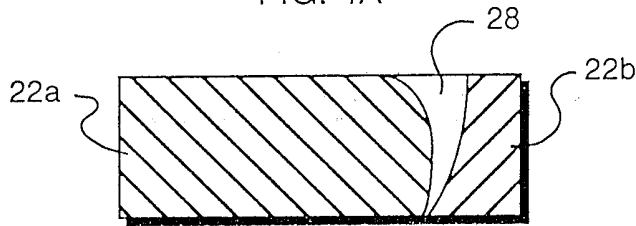


FIG. 4B

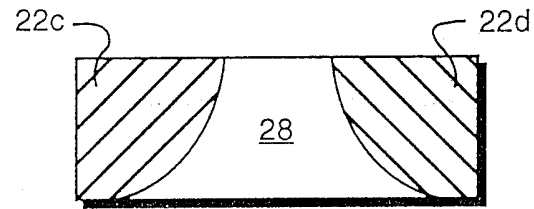


FIG. 5B

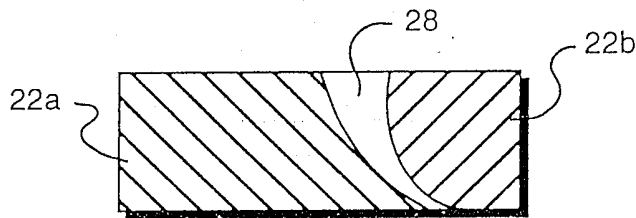


FIG. 4C

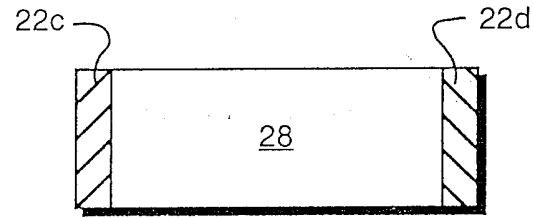


FIG. 5C

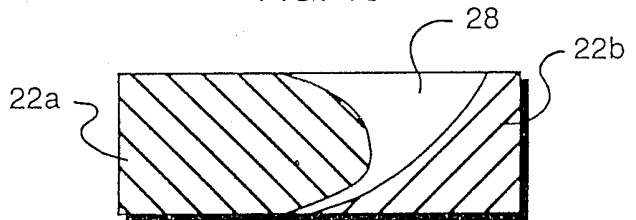


FIG. 4D

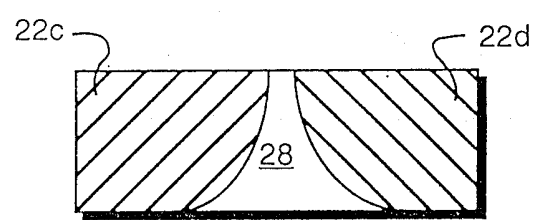


FIG. 5D

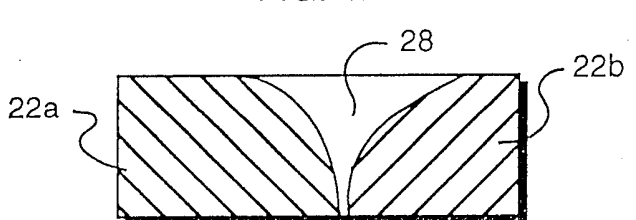


FIG. 4E

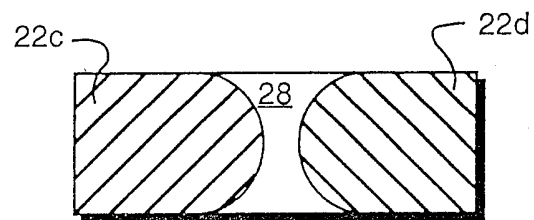


FIG. 5E

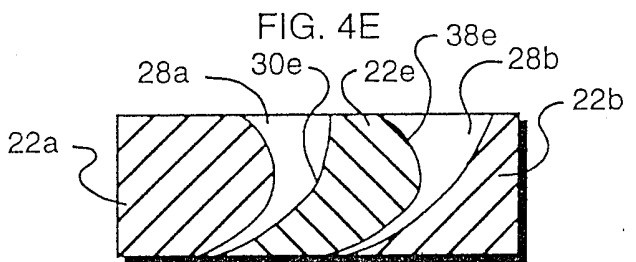


FIG. 4F

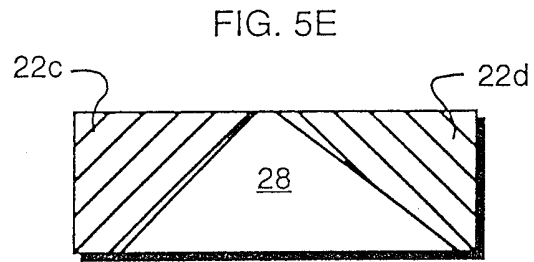


FIG. 5F