(12) **United States Patent**
Downing

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(54) **APPARATUSES AND METHODS FOR PERFORMING MINIMALLY INVASIVE DIAGNOSTIC AND SURGICAL PROCEDURES INSIDE OF A BEATING HEART**

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(51) **Int. Cl.^{7}** **A61B 19/00**
(52) **U.S. Cl.** **128/898**; 606/219; 227/175.1
(58) **Field of Search** 606/108, 191, 606/219, 228; 604/167.01–167.04; 623/2.36, 2.38, 2.39; 227/175.1; 128/898

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(57) **ABSTRACT**

Diagnostic and surgical procedures may be performed on a beating heart using an assembly which includes a port and a fluid transport device. The port has a housing for insertion through a wall of the heart chamber and may include one valve disposed in the housing and an inlet connected to the housing. Methods for repair and diagnosis of the heart are also described. A specific method for repairing a mitral valve uses staples which may be banded together with a strip of material.

4 Claims, 21 Drawing Sheets
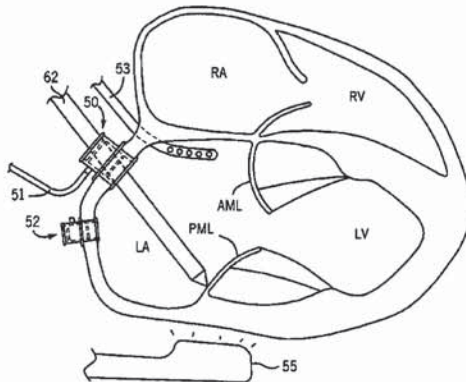
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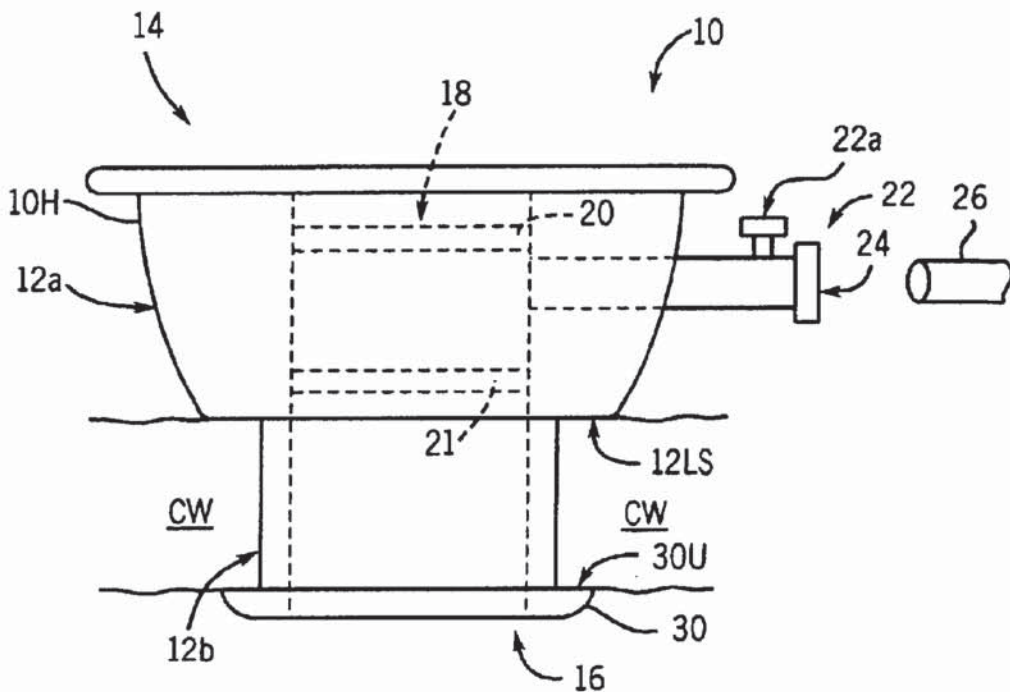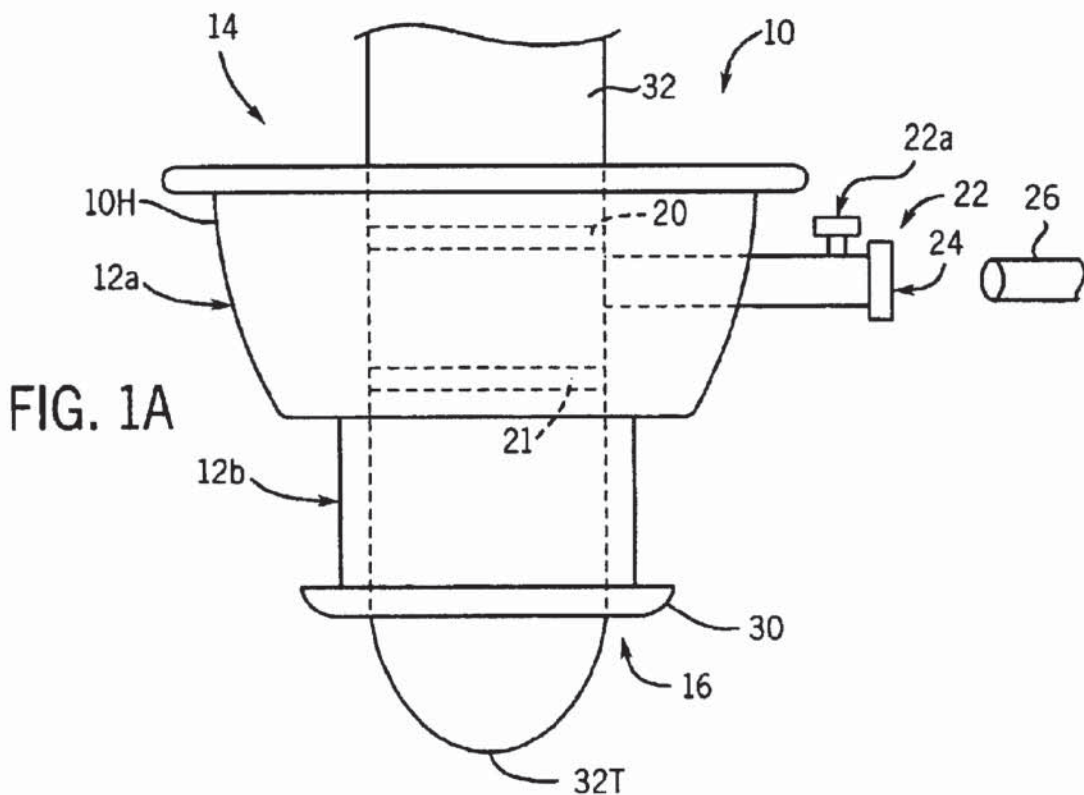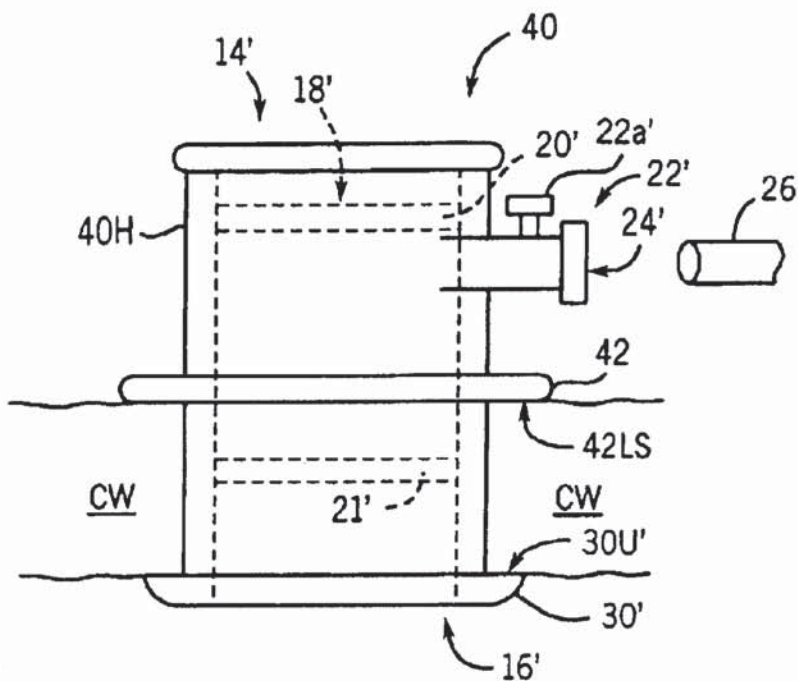St. Jude Medical Corporation, 1998: Personal Communication.

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14
10
18
22a
22
26
10H
20
24
12a
21
12LS
CW
CW
30U
30
12b
16

FIG. 1

14
10
32
22a
22
26
10H
20
24
12a
21

FIG. 1A

12b
30
16
32T

FIG. 2

FIG. 2A

FIG. 3A

4TH RIB DETACHED

PERICARDIUM INCISED

PHRENIC NERVE

5TH RIB RESECTED

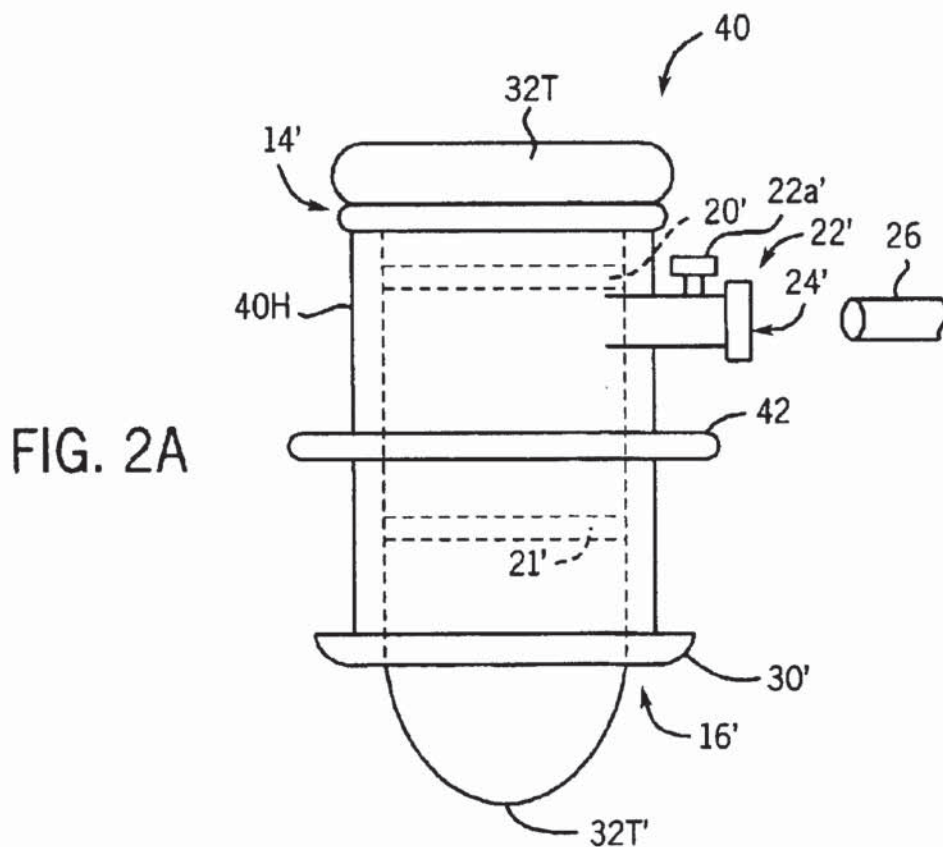INCISION

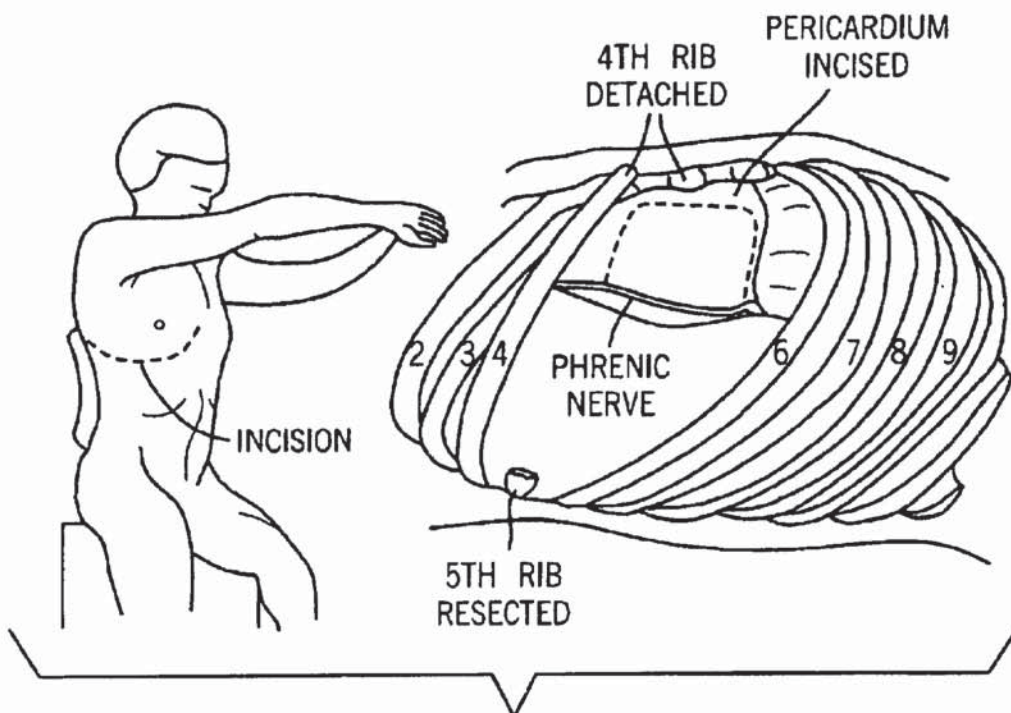2 3 4   6   7   8   9

FIG. 3B

C

CL

P

S

MV

H

FIG. 3C

DOCKET ALARM
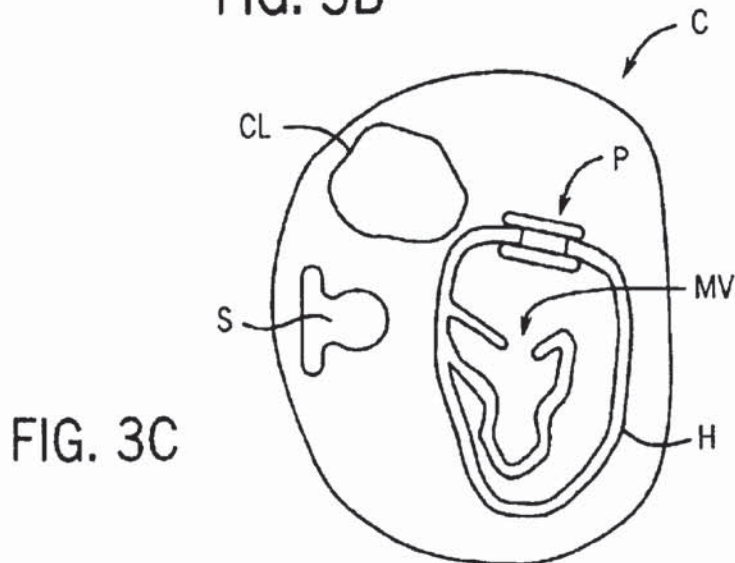
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