



[54] POLYMERIC ARTICLE FOR INTRALUMINAL PHOTOTHERMOFORMING

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Related U.S. Application Data

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[58] Field of Search ..... 623/1, 12; 606/194, 606/195

[56] References Cited

U.S. PATENT DOCUMENTS

- 3,847,771 11/1974 McGinniss .
3,878,075 4/1975 McGinniss .
3,915,824 10/1975 McGinniss .
4,023,559 5/1977 Gaskell .
4,118,470 10/1978 Casey et al. .
4,190,720 2/1980 Shalaby .

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

- 0 200 390 11/1986 European Pat. Off. .
0 355 200 2/1990 European Pat. Off. .
0 466 178 9/1991 European Pat. Off. .
WO 95/08289 9/1994 WIPO .

OTHER PUBLICATIONS

Poppas, D.P. et al., "Chromophore Enhanced Laser Welding of Canine Ureters in Vitro Using A Human Protein Solder: A Preliminary Step for Laparoscopic Tissue Welding", The Journal of Urology, vol. 150, pp. 1052-1055, Sep., 1993.
Choma, T.J., M.D. et al., "CO2 Laser Urethroplasty in the Rabbit: A Preclinical Model", Lasers in Surgery and Medicine, vol. 12, pp. 639-644, 1992.
Kliozze, S.D. et al., "Development and Initial Application of a Real Time Thermal Control System for Laser Tissue Welding", The Journal of Urology, vol. 152, pp. 744-748, Aug., 1994.
Poppas, D.P. et al., "Laser Welding in Urethral Surgery: Improved Results with a Protein Solder", The Journal of Urology, vol. 139, Feb., 1988, pp. 415-417.
Poppas, D.P. et al., "Patch Graft Urethroplasty Using Dye Enhanced Laser Tissue Welding with a Human Protein Solder: A Preclinical Canine Model", The Journal of Urology, vol. 150, pp. 648-650, Aug. 1993.

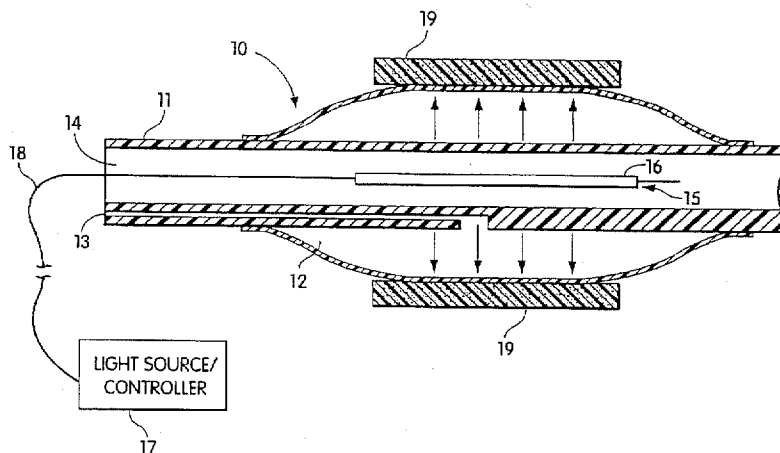
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[57] ABSTRACT

A method and apparatus for molding polymeric structures in vivo is disclosed. The structures comprise polymers that may be heated to their molding temperature by absorption of visible or near-visible wavelengths of light. By providing a light source that produces radiation of the wavelength absorbed by the polymeric material, the material may be selectively heated and shaped in vivo without a corresponding heating of adjacent tissues or fluids to unacceptable levels. The apparatus comprises a catheter having a shaping element positioned near its distal end. An emitter provided with light from at least one optical fiber is positioned within the shaping element. The emitter serves to provide a moldable polymeric article positioned on the shaping element with a substantially uniform light field, thereby allowing the article to be heated and molded at a desired treatment site in a body lumen.

24 Claims, 7 Drawing Sheets



## U.S. PATENT DOCUMENTS

4,286,586	9/1981	Potts .	
4,444,927	4/1984	Borysko .	
4,445,892	5/1984	Hussein et al. .	
4,575,373	3/1986	Johnson .	
4,669,465	6/1987	Moore et al. .	
4,702,917	10/1987	Schindler .	
4,750,910	6/1988	Takayanagi et al. .	
4,754,752	7/1988	Ginsburg et al. .	
4,799,479	1/1989	Spears .	
4,801,477	1/1989	Fudim .	
4,846,165	7/1989	Hare et al. .	
4,878,492	11/1989	Sinofsky .	
4,892,098	1/1990	Sauer .	
4,902,290	2/1990	Fleckenstein .....	623/1
4,955,377	9/1990	Lennox et al. .	
5,009,655	4/1991	Daignault .	
5,053,033	10/1991	Clarke .	
5,059,211	10/1991	Stack et al. .	
5,066,231	11/1991	Oxman .	
5,085,629	2/1992	Goldberg .	
5,092,841	3/1992	Spears .	
5,100,429	3/1992	Sinofsky .	
5,126,141	6/1992	Henry .	
5,139,480	8/1992	Hickle et al. .	
5,145,945	9/1992	Tang .	
5,147,385	9/1992	Beck .	
5,156,613	10/1992	Sawyer .	
5,156,620	10/1992	Pigott .	
5,163,952	11/1992	Froix .	
5,178,618	1/1993	Kandarpa .	
5,185,408	2/1993	Tang .	
5,196,005	3/1993	Doiron .	
5,197,978	3/1993	Hess .....	623/12
5,199,951	4/1993	Spears .	
5,209,776	5/1993	Bass .	
5,213,115	5/1993	Zytkowicz .	
5,213,580	5/1993	Slepian .	
5,226,430	7/1993	Spears .	
5,242,451	9/1993	Harada .....	623/12
5,292,362	3/1994	Bass .	
5,300,020	4/1994	L'Esperance .	
5,312,395	5/1994	Tan .	
5,330,782	7/1994	Kanazawa .....	623/1
5,334,191	8/1994	Poppas et al. .	
5,334,201	8/1994	Cowan .	
5,500,013	3/1996	Buscemi .....	623/1
5,512,291	4/1996	Li .....	623/1

## OTHER PUBLICATIONS

Poppas, D.P. et al., "Preparation of Human Albumin Solder for Laser Tissue Welding", *Lasers in Surgery and Medicine*, vol. 13, pp. 577-580, 1993.

Mehmet et al., "Tissue Soldering by use of Indocyanine Green Dye-Enhanced Fibrinogen with the Near Infrared Diode Laser", *J. Vascular Surgery*, 11:5 (May, 1990).

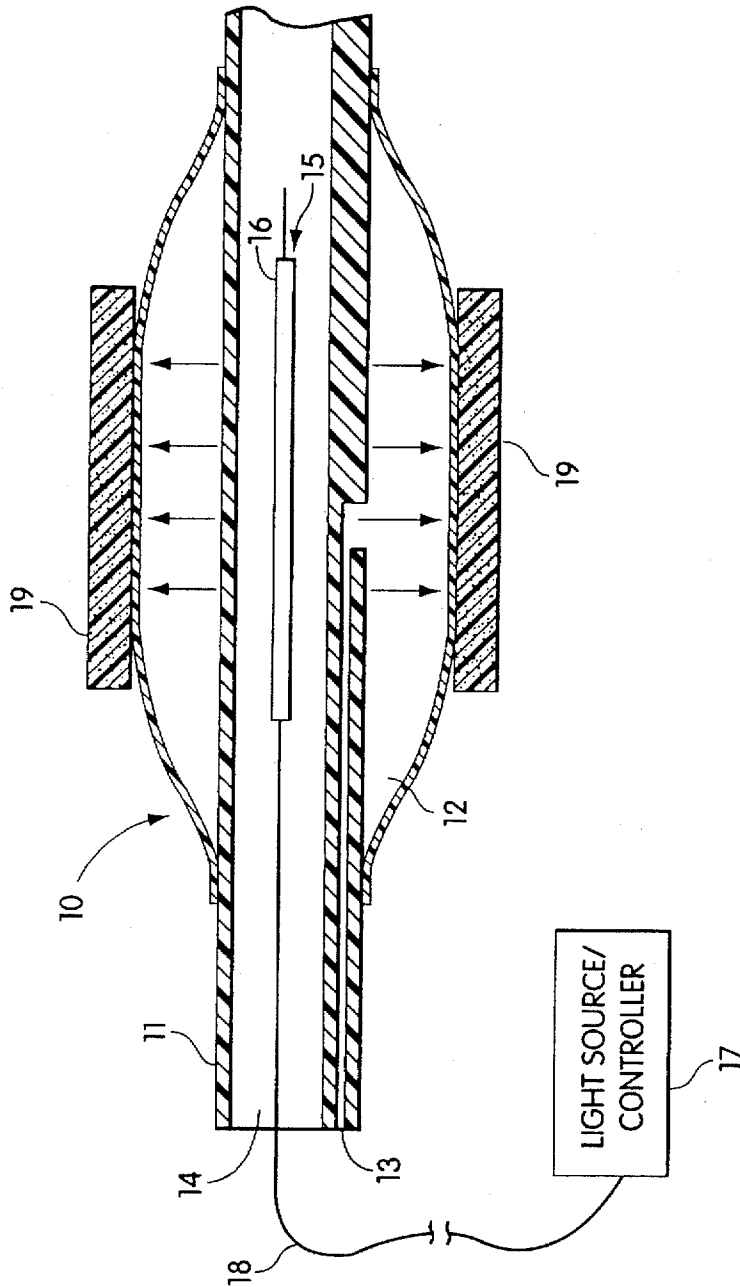


Fig. 1

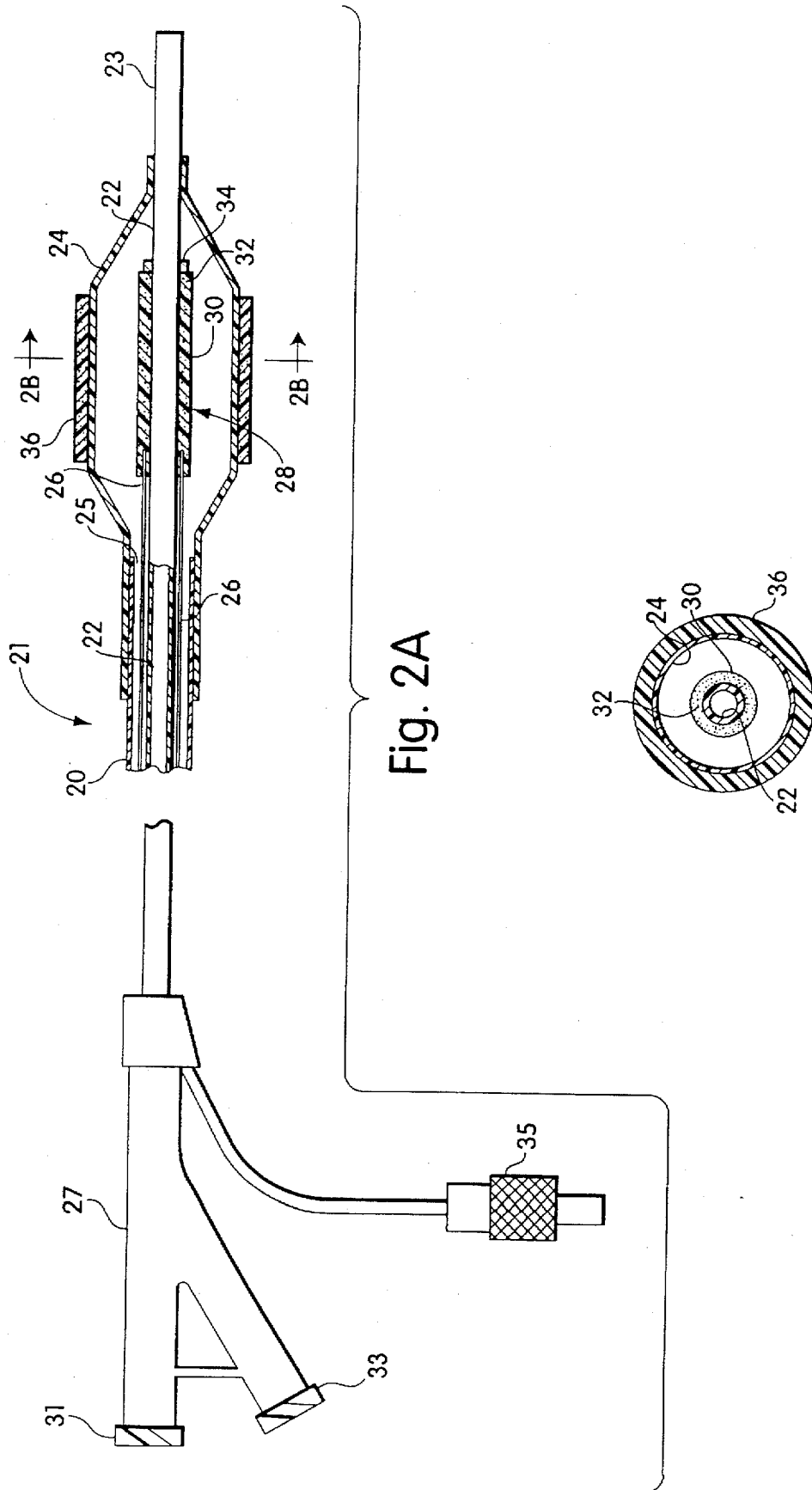


Fig. 2A

Fig. 2B

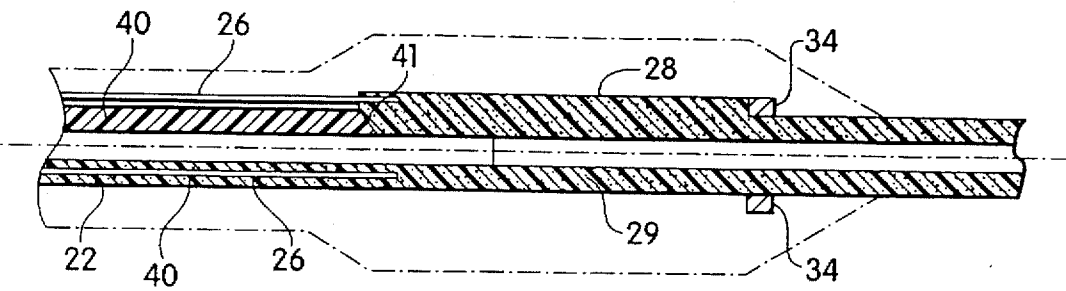


Fig. 3

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