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- [54] **DEHYDRATED COLLAGEN-POLYMER STRINGS**
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Related U.S. Application Data

- [63] Continuation-in-part of Ser. No. 922,541, Jul. 30, 1992, which is a continuation-in-part of Ser. No. 433,441, Nov. 14, 1989, Pat. No. 5,162,430, which is a continuation-in-part of Ser. No. 274,071, Nov. 21, 1988, abandoned.
- [51] Int. Cl.⁵ **C08G 63/48**; C08G 63/91; A61F 2/00
- [52] U.S. Cl. **523/113**; 523/115; 525/54.1; 424/423; 604/11
- [58] Field of Search 525/54.1; 523/113, 115; 424/423; 604/11

References Cited

U.S. PATENT DOCUMENTS

5,162,430 11/1992 Rhee et al. 525/54.1

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[57] ABSTRACT

Medical articles in the form of strings are formed by covalently binding collagen to pharmaceutically pure, synthetic, hydrophilic polymers via specific types of chemical bonds to provide collagen/polymer conjugate formulations which are extruded to make the strings. The collagen may be recombinantly produced human collagen or collagen extracted from any source, such as a bovine source or human placenta, and purified and can be of various types and may be fibrillar or non-fibrillar. The synthetic hydrophilic polymer may be polyethylene glycol and derivatives thereof having an average molecular weight over a range of from about 100 to about 20,000. The string can be designed to incorporate other components such as fluid, pharmaceutically acceptable carriers to form injectable formulations, and/or biologically active proteins such as growth factors or cytokines. The strings contain large amounts of water when extruded and may then be dehydrated to form relatively solid but flexible strings. The strings can be injected into a living being for the purpose of providing soft tissue augmentation. Once in place, the strings rehydrate and expand in size five fold or more. Aqueous solution can be provided to enhance the rate of rehydration. The strings can also be used to suture wounds which strings can be chemically designed to dissolve in situ.

23 Claims, 5 Drawing Sheets