The mock up and verification-patent circumvention on one second needle

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ABSTRACT

This study analyzes the manufacturing process of the two needles. The first needle is the one in US Patent US20100229772, the open eye sewing needle. The second needle is modified version in accordance with the aforementioned US Patent, the modified open eye needle. In the analysis of a first needle in the US patent, the open eye needle, the estimated manufacturing process is mainly based on the spiral eye needle, the artifact of the needle in the US patent. The manufacturing processes are mainly about stamping and wire-EDM. The manufacturing process of second modified open eye needle is similar to the first one, but the manufacturing process is relatively simple, because the open eye needle pinholes structure is improved and has a relatively simple channel. In order to verify the manufacturability of the second improved open eye needle, a stainless steel 17-4PH round bar is taken as the raw material in the needle making. A wire-EDM plant in the local, Yuan-Lin Township, is hired to do the needle making. The formula of deflection of cantilever beam is used to calculate the critical dimension in the second open eye needle. The length of spring board is set as 10 mm, the highest thickness of the arc-shaped cross section in the spring board is 0.5 mm. In order to bend the spring board in 0.55 mm, the load is required to be 0.17 kg. Such an open eye needle structure allows the common sewing thread to be easily slipped into the open eye region, and can avoid the escaping of the sewing thread away from the open eye region. The DIN code for stainless steel 17-4PH is 1.4542, which is not included in the SolidWorks database. Thus in the further simulation of strain, stress and deflection of the spring board, a DIN 1.4541 is substituted instead. The chemical composition of DIN 1.4542 and 1.4541 is very similar. In the SolidWorks simulation of strain, stress and deflection for DIN 1.4541, when the length of spring board is 10 mm, the thickness of its cross section is 0.5 mm, applying the load of 0.174 kg to the end of cantilever beam, as represented by spring board, the maximum stress is 431082816(N/m2). This stress does not exceed the yield strength 431082816(N/m2), which means the load will not damage the spring board. The maximum strain is 1.724*10-3, the maximum deflection is 2.165*10-1 mm. The deviation between simulated value and theoretical value may be due to the different materials.

Keywords : wire-EDM, stainless steel 17-4PH, open eye needle, stress

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REFERENCES

1.余煥騰、陳適範、唐自標，(民 87)，?屬熱處?學，六和出版社，台北市。 2.陳慧君 (民 96)，台灣不銹鋼品需求預測之研究，靜宜大學管理碩士在職專班碩士論文。 3.黃士瑋 (民 92)，使用電泳沉積研磨加工改善放電微孔精度之研究，國立中央大學機械工程研究所碩士論文。 4.簡文通 (民 93)，機械製造，全華科技圖書股份有限公司，台北市。 5.Gere, J. M. (2004) Mechanics of Materials, 6th Ed., 906. Brooks/Cole-Thomson Learning, Belmont, CA. 6.Isogawa, S., H. Yoshida, Y. Hosoi and Y. Tozawa (1998) Improvement of the forgability of 17-4 precipitation hardening stainless steel by ausforming. Journal of Materials Processing Technology, 74, 298-306. 7.Lee, B. T. (1986), The Personal Reminiscences of a Needlemaker, Merlin Books LTD, Braunton, Devon. 8.Liao, Y. S., S. T. Chen and C. S. Lin (2005) Development of a high precision tabletop versatile CNC wire-EDM for making intricate micro parts. Journal of Micromechanics and Microengineering, 15, 245-253. 9.Pressman, D. (2009), Patent It Yourself, 14th Ed., Nolo, Berkeley, California. 10.Rogers, G. A. (1983), Needle Work Tools, Needlework Unlimited, Claremont, CA. 11.慶鴻電機工業股份有限公司，線切割介紹。
[Online] Available: http://www.chmer.com/tw/faq.html (民 101.8.28) 12.3M NextelTM Ceramic Textile Technical Notebook.
[Online] Available:
http://multimedia.3m.com/mws/mediawebserver?mwsId=SSSSSufSevTsZxtUnxme4Y_ZevUqevTSevTSevTSeSSSSSS--&fn=Nextel_Tech_Notebook_11.04.pdf (民 101.8.28) 13.Entaco needle.
[Online] Available: http://www.youtube.com/watch?v=RxmJ167obYw (民 101.8.28) 14.How Spiral eye needles are made.
[Online] Available: http://www.spiraleyeneedles.com/Facts.html [Online] Available: