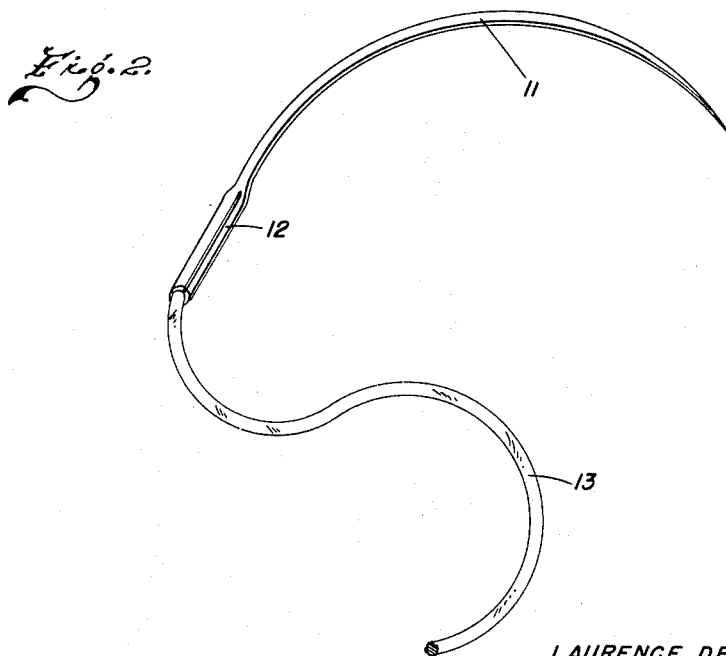
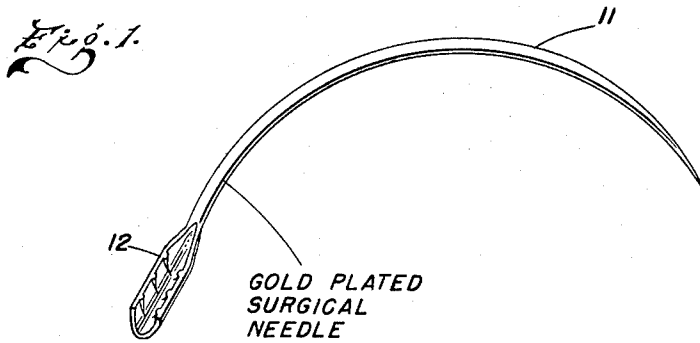


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GOLD PLATING SURGICAL NEEDLES

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GOLD PLATING SURGICAL NEEDLES

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This invention relates to a process for preparing shiny, corrosion-resistant gold plated needles for surgical sutures.

Surgical needles are generally made from a carbon steel which gives a tough sharp needle point which penetrates the tissues and which maintains an edge. Many of the needles are of the so-called eyeless type in which the back end of the needle has means for attaching a single strand of suture to the needle. Sutures with the needles attached are stored until time for use in various conditioning fluids which, while necessary for maintaining the sutures in proper condition, are apt to have undesirable effects upon the needles. In the past corrosion inhibitors have been added to conditioning fluids to protect the needles and keep them in condition for use. In other instances sutures are stored dry in which case it has been necessary to take rather costly precautions for insuring that the needle is maintained in such a dry atmosphere that corrosion does not occur.

It is obviously advantageous to have a needle which is resistant against corrosion.

Gold is a well-known material which is resistant to corrosion and which can give a brilliant shiny plate. However, in the past it had not been convenient to obtain an adequate gold plate on surgical needles because it had been regarded as difficult or impossible to form a plate on the surface which meets the requirements of ductility, adherence, corrosion-resistance, and low cost.

Surprisingly, it is found that an electrodeless plate of gold from an alcoholic solution readily forms in a shiny condition on the surface of the steel needle, as herein more fully described.

Because the procedure is strictly catalytic in nature, poor throwing power which causes difficulties in electroplating objects of irregular configuration does not affect the uniformity of the plate. Surprisingly, a coat the thickness of which is too thin to conveniently measure is sufficient to give the needles the required corrosion-resistance. The needles plated by the present procedures have been subjected to laboratory atmosphere for periods up to several months without corrosion. It is expected that the needles will be corrosion-resistant over a period of many years under normal conditions of storage, and usage.

Whereas under many conditions gold comes out of a solution in the form of a sol, or in the form of a black finely divided coating, by using a monohydric or polyhydric alcohol solution of a gold salt, such as gold chloride, a direct plating is obtained without the necessity of addition agents, or specialized treatment conditions. Among the alcohols which can be used are methyl alcohol, and ethyl alcohol which may contain a small percentage of water. Ethyl alcohol containing a small percentage of benzene, such as is common to denature the alcohol and render it unfit for human consumption, is very satisfactory. Higher alcohols may be used if available. Polyhydric alcohols, such as ethylene glycol or the higher polyhydric alcohols may also be used, or mixtures of these alcohols may be used. Conveniently methanol or ethanol

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are used because they are readily available and their volatility renders drying particularly convenient.

Whereas other salts may be used the gold is most conveniently used as the gold chloride because it is readily commercially available in this form. From 60 to 120 milliliters of the alcohol may be used to dissolve each 0.1 gram of the gold salt. A more dilute solution may be used if a longer time for plating is used but if too dilute a solution is used corrosion may occur, and if too concentrated a solution is used a non-adherent black plating may be obtained. Using 1/10 gram of gold chloride in 90 milliliters of alcohol, a satisfactory plate is obtained in from 30 to 90 seconds at room temperature. As soon as the needles have been plated they are removed from the plating bath, immediately washed with alcohol, preferably a volatile alcohol, which is conveniently, but not necessarily, the same alcohol as is used to form the gold solution, and then permitted to dry.

The needles need not be given a particular pre-treatment for plating. They need to be clean and are preferably pickled by immersing in a dilute aqueous acid. For cleaning the needles may be either degreased in a mixture of solvents such as ligroin, xylene, and methyl-ethyl ketone after which they are rinsed in acetone, dried, and then pickled in dilute acid, for instance 1% hydrochloric acid; or they may be cleaned by using alkaline cleaners, such as the trisodium phosphate types, or by use of commercial cleaners, which are usually used in preparing metals for electroplating procedures. The exact method of cleaning is not critical as long as the needles are clean and free from scale. The rinsing in dilute acid insures a more adequate plate, as it tends to insure against oxide coatings on the surface of the steel needles; but it may be dispensed with if the needles are clean and oxide-free.

A chelating compound which will chelate ferrous metals such as the sodium salt of ethylenediamine tetraacetic acid may be used in the rinsing solution which is used to wash the needles after they have been plated. Such materials insure against iron remaining on the surface of the plated needles which might cause them to show rust spots.

The accompanying drawings show:

Figure 1 is a gold plated needle.

Figure 2 is a gold plated needle with suture attached.

As shown in Figure 1 eyeless needles 11, which do not have an eye but instead have a flange 12 which is closed about the suture 13, presents a particularly difficult problem in plating because the plate must be sufficiently adherent that the flange of the needle may be closed about the suture without the plate being destroyed or cracked. At the same time the plate must be sufficiently thick to be protective against whatever corrosive agents may come in contact therewith.

Figure 2 shows the needle after it has been attached to a suture.

The following examples are illustrative of our invention which is defined by the appended claims:

Example 1

In 90 milliliters of 95% ethyl alcohol containing 0.5% benzene as a denaturate is dissolved 0.1 gram of gold chloride. 100 steel eyeless needles designed for a 00 gut suture are washed twice in a solution of 40 parts by volume xylene, 40 parts by volume if ligroin, and 20 parts by volume of methyl-ethyl ketone. The needles are then washed in acetone, and permitted to dry. The needles are dipped in 2% hydrochloric acid solution for 30 seconds, removed, washed with water until neutral to litmus, and then dipped in the above gold chloride in alcohol solution for 45 seconds, removed, and washed with additional alcohol until the gold chloride is washed therefrom and then air dried. There is obtained a group of bright gold plated needles which, while having a film

of gold too thin to be conveniently measured, are protected against corrosion by the atmosphere for a period of at least some several months, and which gold plate is sufficiently adherent to permit the closing of a flange about a suture without cracking or disrupting of the plate. Needles to which sutures are attached are not affected by conditioning fluids over a period of at least several months.

Example 2

A group of needles cleaned and acid pickled as in Example 1 are dipped in a solution of 0.1 gram of gold chloride dissolved in 120 milliliters of methyl alcohol, for 90 seconds. The needles are removed, and rinsed in methanol containing 0.2% of ethylenediamine tetraacetic acid sodium salt, then rinsed with clear alcohol, and permitted to dry. These needles also are satisfactory as to plate, as to color, as to adherency, and as to corrosion-resistance.

Example 3

100 steel needles designed for a number 6/0 gut are washed in trisodium phosphate solution until free from oil, then washed with water, until free from the trisodium phosphate, then dipped in a 2% hydrochloric acid solution for 5 minutes. The needles are then removed, and dipped for 30 seconds in a solution of 0.1 gram of gold chloride dissolved in 60 milliliters of ethanol. The needles are removed, washed with ethanol containing 0.05% of ethyl-

enediamine tetraacetic acid sodium salt, then with clear alcohol, and permitted to dry. These needles are also corrosion-resistant, and have an adherent plate. The needles are attached to gut sutures without damage to the plate.

We claim:

1. A process for preparing shiny, corrosion-resistant gold plated needled surgical sutures which comprises: cleaning steel eyeless needles, and immersing in an alcoholic solution of gold chloride containing 0.1 gram of gold chloride per 60 to 120 milliliters of solution, for between 30 and 90 seconds, and rinsing the needles with an alcoholic rinse.

2. The process of claim 1 in which the rinse contains an iron sequestrant.

3. The process of claim 1 which comprises the additional step of swaging to suture strands.

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