

UNITED STATES PATENT OFFICE

2,491,416

TANTALUM OXIDE COMPOSITION

Carl T. Olson, Highland Park, and Roger W. Hoffmann, Waukegan, Ill., assignors to Fansteel Metallurgical Corporation, North Chicago, Ill., a corporation of New York

No Drawing. Application April 3, 1946,
Serial No. 659,426

3 Claims. (Cl. 167—58)

1

This invention relates to a new article of manufacture which is particularly adapted for use as a medical and surgical dusting powder and as a wound dressing.

It is common practice today to cover wounds with sterilized gauze, sterilized Vaseline gauze, liquid antiseptics or medicated ointments. These materials when placed directly over the wound are quite irritating to many people and interfere with the natural processes of wound healing. It is an accepted fact that a wound will heal most rapidly if it has been thoroughly cleansed mechanically with soap and water or with a sterile normal saline solution and is then covered with a nonirritating dressing. In the method of wound dressing as commonly practiced today, the lag period during which devitalized cells and whatever bacteria may be present are removed is unduly prolonged because the type of dressing results in destruction of partially devitalized cells and furtherance of bacterial growth. A clean wound properly dressed will not be overcome by infection due to the growth of pathogenic bacteria which are always present in small amounts. It is always essential that the bleeding and oozing in the wound area be stopped and the wound kept dry.

In view of these facts, it is apparent that in handling injured tissue it is very essential that the tissue be first thoroughly cleansed and then covered in such a manner that the normal healing processes may proceed. For some time past it has been recognized that metallic tantalum does not cause unfavorable reactions in the tissues of the body. This is due in large part to the fact that metallic tantalum does not enter into any physical or chemical solution in the body tissues. It has been demonstrated that when a superficial skin wound, in which there has been partial loss of thickness, is covered with tantalum foil placed in intimate contact with the wounded area, as by compression, healing progresses with a minimum of lag. The tantalum foil is nonirritating to the injured tissue. For ordinary purposes, the use of tantalum foil is impracticable because it can be used in only a few locations due to its inability to follow the anatomical contours.

The principal object of this invention is to provide a new article of manufacture which is particularly adapted to attain the results of a non-

2

irritating wound covering utilizing the advantages of tantalum.

Another object of this invention is to provide a new article of manufacture which when used as a wound covering accelerates the coagulation of the blood and other fluids thereby effecting a rapid clotting and stoppage of bleeding and leakage of tissue juices.

Other objects and advantages of this invention will become apparent from the description and claims which follow.

The present invention is based upon our discovery that finely divided tantalum oxide or tantalum oxide powder, preferably containing a small amount of iron present as iron oxide and which is free of silica, fluorides and alkaline substances provides a most excellent material for covering wounds. Within a relatively short space of time after this powder has been applied to a wounded area there is a crust formation which results in the stoppage of sanguineous oozing and wound seepage. The crust which is formed adheres tenaciously to the wounded surface until such time as healing has taken place underneath at which time the crust falls off by itself. The crust is so firm and impervious that it does not permit the entrance of contaminating pathogenic bacteria to the wounded tissue. This firm crust permits the outer gauze dressing to be changed at frequent intervals without fear of secondary infection.

In the use of many of the conventional wound coverings, a crust or shell is formed and if infection is present pus is trapped under the covering. When the tantalum oxide material of this invention is used as a wound covering, a tough crust is not formed where infection is present so that there is no trapping of pus under the wound dressing.

In our experience, as soon as a skin wound has been covered with this powder there is no further pain due to the tight sealing off of the tissue. It has also been our experience that many areas of skin loss which would ordinarily require skin grafts will heal without the use of skin graft when the powder crust has formed. The powder is of especial benefit in the treatment of burns wherever there has been loss of the superficial layers of the skin due to physical or chemical agents.

We have discovered that tantalum oxide powder which functions as described hereinbefore consists of particles of a certain size and preferably contains a small portion of iron oxide. The iron content should be between about 0.01% and about 0.10%, preferably about 0.025% to about 0.04%.

The material is in powdered form and may contain aggregates of the individual particles. The individual particles which are particularly adapted for the aforementioned medical and surgical purposes have a particle size of between about 0.1 micron to about 2.5 microns and we prefer to employ a powder in which the majority of the individual particles have a size or diameter of from about 0.5 micron to about 1.5 microns. Some individual particles may be appreciably larger. Aggregates which may be found in products having a major number of individual particles of the size mentioned will range up to 5 to 10 microns. The presence of these relatively large sized particles and aggregates does not appear to inhibit or suppress the action of the powder. We have found that a powder in which about 70% of the particles have a diameter of not more than about 0.55 micron and about 90% of the particles have a diameter of not more than about 1.5 microns is very satisfactory for use as a wound covering. The remainder of the particles and aggregates may have a size up to about 5.5 to 6.0 microns.

The powder may be prepared in any desired manner. We prefer to prepare the powder by ignition of tantalum. If the presence of iron is desired, the powder is preferably prepared by ignition of tantalum which contains sufficient iron so that the oxidized material contains the required small proportion of iron oxide. Tantalum powder containing the required amount of iron serves as a convenient and the most satisfactory source of the tantalum and iron for the ignition process. It is obvious that since a finely divided product is desired, it is highly desirable to use as the metal source, finely divided tantalum powder. We prefer to employ tantalum powder containing from about 0.03% to about 0.06% iron, the powder being of such size that it passes through a 200 mesh screen, preferably a 400 mesh screen.

The size of the individual particles and aggregates may be controlled by the rate of ignition. A relatively slow rate of ignition produces a product having the required particle size and the aggregates are of satisfactory size. A rapid rate of ignition appears to result in the production of a material having substantially greater individual particle sizes. We have also found that the product produced by the rapid ignition is somewhat gritty to the touch, whereas the product produced by the slow ignition is somewhat soft to the touch approaching that of usual talcum or like powders.

Ignition is effected by heating the powdered metal above about 600° C. in a limited amount of oxygen or air and maintaining the mass at such temperature for a period sufficient to oxidize the metal. It is obvious that shorter periods may be used at higher temperatures. Restricting the amount of oxygen present obviously retards the rate of oxidation. The oxygen supply may be restricted or limited by heating the metal in a loosely covered tray or container. We prefer to heat the powder in loosely covered trays or containers to a temperature of from about 610° C. to about 625° C. and maintain the mass at this temperature for from about 20 hours to about 26 hours. Ignition may be accomplished by heating

to a temperature of about 700° C. and maintaining the mass at this temperature for about 4 hours. This relatively rapid ignition, however, produced a product which is somewhat gritty to the touch.

The advantages of this method of preparing the powder are quite obvious. The iron oxide content may be carefully controlled and there is substantially no opportunity for contamination of the product where it is intended for medical or surgical purposes. Since the initial material is free of silica, alkalies and fluorides there is no possibility that such materials will be present in the finished product. The great bulk of the product is of the required size and larger particles and extremely large aggregates may be removed by screening.

Because the powder is nonreactive and will not go into solution in any of the body tissues it is of benefit as a surgeon's glove powder in place of the commonly used talc which has been known to produce granulomata. The powder is valuable as a dusting powder for babies. Powder intended for such purposes may be free of iron. It also is of great value in the treatment of weeping dermatitis. It is of use in packing cavities such as are left by freshly extracted teeth.

The tantalum oxide powder of this invention serves as an excellent carrier for bacteriostatic and bactericidal agents such as sulfa drugs, for example, sulfanilamide, sulfathiazole, and the like, penicillin, streptomycin, tyrothricin and the like. These preparations or compositions are prepared by thoroughly mixing the powdered tantalum oxide with the powdered agent or by moistening the tantalum oxide powder with the liquid agents.

We claim:

1. The method of preparing tantalum oxide powder containing a small amount of iron oxide which comprises heating powdered tantalum containing a small amount of iron to a temperature above about 600° C. for from about 20 hours to about 26 hours in a limited amount of oxygen, the individual particles of tantalum containing iron being of a size sufficiently small to pass a 200 mesh screen.

2. As a new article of manufacture, a wound dressing composed of tantalum oxide powder containing a small amount of iron oxide, the powder being free of silicon, fluorides and alkaline substances and being formed by heating powdered tantalum containing a small amount of iron to a temperature above about 600° C. for from about 20 hours to about 26 hours in a limited amount of oxygen, the particles of tantalum containing iron being of a size sufficiently small to pass a 200 mesh screen.

3. As a new article of manufacture, a wound dressing composed of tantalum oxide powder containing iron oxide equivalent to from about 0.025% to about 0.04% iron, about 70% of the individual particles having a size of not more than 0.55 micron, about 90% of the individual particles having a size of not more than about 1.5 microns and the remainder consisting of individual particles and aggregates having a size of not more than about 6.0 microns, the powder being free of silicon, fluorides and alkaline substances and being formed by heating powdered tantalum containing a small amount of iron to a temperature above about 600° C. for from about 20 hours to about 26 hours in a limited amount of oxygen, the particles of tantalum containing

5

iron being of a size sufficiently small to pass a 200 mesh screen.

CARL T. OLSON.
ROGER W. HOFFMANN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,596,979	Kohlschutter -----	Aug. 24, 1926
2,160,503	Herrmann -----	May 30, 1939
2,269,059	McLachlen -----	Jan. 6, 1942

6

OTHER REFERENCES

- Perry, "Chemical Engineer's Handbook," Second ed., page 1917, McGraw-Hill, New York (1941). (Copy in Div. 59.)
- 5 Mellor, "Inorganic and Theoretical Chemistry," vol. 9, pages 890, 896, Longmans, London (1929). (Copy in Division 59.)
- 10 King, American Dispensatory, page 1026, Cincinnati, 1870. (Copy in Division 43.)
- Anonymous, J. A. M. A., page 129, Sept. 9, 1944, "Sutureless Reunion of Nerves with Elastic Cuffs of Tantalum." (Copy in Division 43.)