106 - 84 CROSS REFERENCE EXAMINER

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ELECTRICAL-HEATER RESISTANCE ELEMENT.

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To all whom it may concern:

Be it known that I, ROBERT WOOLRIDGE REYNOLDS, subject of the King of Great Britain and Ireland, residing at 61 Roslyn Street, Darlinghurst, near Sydney, in the county of Cumberland and State of New South Wales, Australia, have invented certain new and useful Improvements in Electrical-Heater Resistance Elements, of which the following is a specification.

According to a known process electrical heater resistance elements are constituted of a film of a paint like substance which is applied to a support consisting of a heat tolerant electric insulating material, by painting it on said material and allowing it to dry upon it in situ.

This paint is composed of powdered graphite, chemically precipitated silicates, and a proportion of sodium silicate or of potassium silicate. In use quite satisfactory service is obtained and the films are notably permanent in their character, showing no tendency to disintegrate or to shell or fret away from the support. They maintain substantially uniform resistance characteristics while in continuous or intermittent use, but they are faulty in one minor respect. When the elements are placed in store or stock for a prolonged period the electrical resistance of the paint film increases, thereby affecting the heating effect of the element. This high resistance gradually diminishes while the element is in use until it reaches the normal point, and thereafter it remains substantially constant, and the heating value likewise remains substantially constant so long as the element is maintained in continuous or intermittent use. It has, therefore, been found desirable to devise a means whereby this augmentation in resistance of the film during idle periods may be prevented, and the present invention consists in means for curing the fault referred to so as to invest the painted film with approximately constant electrical resistance value, and consequently ensure that the heating value of the element will remain substantially uniform whether the unit be maintained in use or stored away.

The tendency of the painted film to augment its resistance when out of use can be reduced by reducing the proportion of sodium silicate or potassium silicate in it to a low point, but even then the faulty condition will not be sufficiently removed to satisfy commercial requirements, and there is a point below which it is not advisable to reduce the proportion of sodium silicate or potassium silicate without running the risk of endangering the mechanical stability of the film, in which case it would no longer remain permanently attached to its support and resist scaling and fretting satisfactorily. It is highly desirable to maintain the proportion of sodium silicate or potassium silicate in the composition at about normal value to ensure quite satisfactory mechanical permanency of the film.

It has been ascertained experimentally that if films prepared and applied in the known manner, are treated with dilute sulphuric acid or dilute hydrochloric acid after the drying process has been completed, and are subsequently washed with warm water, the objectionable behaviour of the film in respect of its electrical resistance is prevented. For this purpose the films are washed with the acid solution and after such treatment are thoroughly washed in running water. The films are thus "set", and retain permanently the initial electrical resistance values which they display when first dried out.

When the treatment of the film with dilute acids is practised it is found that in the making up of the film composition a higher proportion of added silicate of soda or silicate of potash may be used than is otherwise practicable, with the result that greater tenacity and longer life of the film is assured.

In the manufacture of film composition according to this invention, an aqueous solution of sulphate, chloride, or other suitable salt of aluminium is added to an aqueous solution of commercial sodium silicate. A white gelatinous precipitate is thus produced. The addition of the aluminium salt is continued only so long as precipitation continues to take place; thereafter the precipitate is permitted to settle for ten to fifteen minutes, more or less. The bulk of the supernatant liquor is then removed by siphoning or otherwise, and very fine flour graphite and a minor proportion of sodium

silicate are added and thoroughly incorporated with the precipitate by mixing whilst wet.

The proportions of the substances used are in the following ratio or thereabouts:

8 oz. commercial water-glass containing about 35% sodium silicate.

8 oz. water.

Aluminium salt sufficient to precipitate.

The precipitate obtained from the foregoing materials is intermixed with 4 ounces of fine flour graphite and one fluid ounce of commercial water-glass.

The paint-like substance thus constituted is applied to a heat tolerant support such as mica or a fire-enamelled metal sheet or plate, care being taken to ensure that the electrical resistance of the enamel is sufficiently high to avoid wasteful leakage. The paint is applied to the support by means of a soft brush to form a skin or film on it, and contacts offering a large surface are applied to the terminals of the painted-on film.

After the film is thoroughly dry it is submitted to the process in which this invention consists, that is to say it is freely washed in a dilute (i. e. 10% more or less) aqueous solution of sulphuric acid or hydrochloric acid once or oftener, and immediately after the acid washing it is rinsed thoroughly several times in running water. The film is then again allowed to dry, and when dry is found to have constant electrical resistance, so that even after prolonged cessation of use its utility is not diminished, and a period of delay in use is not, as heretofore, encountered in waiting for the film to develop its normal resistance.

What I claim as my invention and desire to secure by Letters Patent is:—

The herein described improvement in the manufacture of electrical resistance films composed of precipitated siliceous material, graphite, and an alkaline silicate, which consists in washing said films after they are set on their supports with a dilute solution of sulphuric acid or hydrochloric acid and subsequently washing them with water.

In testimony whereof I affix my signature.

ROBERT WOOLRIDGE REYNOLDS.