UNITED STATES PATENT OFFICE.

WALTHER NERNST, OF GÖTTINGEN, GERMANY, ASSIGNOR TO GEORGE WESTINGHOUSE, OF PITTSBURG, PENNSYLVANIA.

GLOWER FOR ELECTRIC LAMPS.

SPECIFICATION forming part of Letters Patent No. 685,733, dated October 29, 1901.

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To all whom it may concern:

Be it known that I, WALTHER NERNST, a subject of the Emperor of Germany, and a resident of Göttingen, Empire of Germany, have invented certain new and useful Improvements in Glowers for Electric Lamps, of which the following is a specification.

In the operation of electric lamps of the class in which glowers are formed of materials which are practically non-conductors when cold and require to be heated to be rendered conductive it is desirable that the glowers shall be capable of being operated for a considerable period of time with but little change in the voltage required to cause a given current to pass through them and that they shall vary as little as possible in the amount of light which they emit during their period of operation, also that they shall have mechanical strength sufficient to withstand ordinary usage. I have experimented with many different substances which increase in conductivity as they become heated, and I have subjected them to a great variety of tests and have used them for actual lighting purposes during many hours of service. I have made glowers consisting principally of the oxid of zirconium and having combined or mixed therewith varying percentages of all of the rare earths commonly found in the so-called "yttrium group" and, in fact, with various other of the rare earths, and I find that excellent glowers may be made by combining or mixing from seventy per cent. to ninety per cent. of zirconia with any or all of the rare earths of the yttrium group in such proportions as they occur in any mineral containing any or all of them. I find, for instance, that if I combine with zirconia such of the yttrium earths as are found in any mineral containing any or all of them in the proportions of from ninety per cent. to seventy per cent. of zirconia and from ten per cent. to thirty per cent. of the others in their natural proportions a mixture is made from which I am able to produce glowers having most or all of the qualities desired. In some cases I find it desirable to separate the rare earths into two divisions, the one containing the earths belonging to the cerium group and the other containing those belonging to the yttrium group, and to make use of the yttrium group, omitting the cerium group; but this livision is not always necessary.

The manner in which I make a glower having the constituent elements above referred to is to take the desired percentage of oxid of zirconium and mix therewith the desired percentage of the rare earths found in the mineral containing any or all of them, both in a powdered state, and form from them a paste by adding water and some suitable binding material—as, for instance, tragacanth, dextrine, or the like. The powdered oxids are first thoroughly mixed together, and the binding material may be also finely powdered and thoroughly mixed with the oxids. Sufficient water is added to form a paste, and the glowers are then shaped by any desired process. The metals ordinarily regarded as belonging to the yttrium group are yttrium, erbium, terbium, ytterbium, scandium, and such metals as thulium, holmium, dysprosium, gadolinium, and decipium, which latter are by some chemists ascribed to the yttrium group. The cerium group comprises cerium, didymium, samarium, and some others of hypothetical existence. The metals of the cerium group may sometimes be present in the mixture without inconvenience; but usually they tend to somewhat lower the temperature at which the glower may be safely operated. This method of preparing glowers or the mixtures from which the glowers are to be made greatly facilitates the process, for it simplifies the process of preparing and refining the materials, as practically it is quite difficult to separate certain of the different rare earths from each other, so that it is only necessary to refine the minerals by separating out from them the materials other than the metals of the yttrium group. The past is pressed or molded into the desired shapes or forms and properly dried and baked, being brought to a high temperature by heat suitably applied. Terminal conductors are attached in any convenient manner.

I claim as my invention—

1. A glower for electric lamps composed of approximately eighty parts of the oxid of zir-

conium and twenty parts of a mixture of those metals of the yttrium group which occur in an yttrium-containing mineral.

2. A glower for electric lamps composed of a predetermined per cent. of oxid of zirconium and a mixture of the rare earths of the yttrium group in such proportions as they are found associated in nature.

3. A mixture of rare earths for forming glowers for electric lamps consisting of a preponderance of zirconia together with such of the rare earths of the yttrium group as are contained in yttrium-containing minerals in approximately the proportions that such earths are found therein.

Signed at Berlin, in the Empire of Germany, this 23d day of October, A. D. 1900.

WALTHER NERNST.

Witnesses:
WOLDEMAR HAUPT,
HENRY HASPER.