UNITED STATES PATENT OFFICE.

JOHN LANDIN AND AUGUST JERNANDER, OF STOCKHOLM, SWEDEN.

IGNITING COMPOSITION FOR MATCHES.

SPECIFICATION forming part of Letters Patent No. 681,799, dated September 3, 1901.

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To all whom it may concern:

Be it known that we, JOHN LANDIN and AUGUST JERNANDER, engineers, of Drottninggatan 40, Stockholm, Sweden, have invented certain new and useful Improvements in Igniting Composition for Matches; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention has relation to the manufacture of matches and to an igniting composition to be applied thereto; and it has for its object a practically non-explosible and comparatively slow-burning igniting composition free from poisonous constituents, practically proof against dampness, and ignitible by frictional contact with any suitable or more or less rough surface.

It is well known that a mixture of an oxygen-yielding substance or compound—as, for instance, potassium chlorate—and a readily-ignitible substance—as, for instance, carbon or amorphous phosphorus—will form an explosive compound which could not be used as an igniting composition for matches not only because of its danger, but because of its too-rapid combustion to insure the ignition of the match splint or stem. The substitution of carbon or of the red or amorphous phosphorus for the poisonous white phosphorus hitherto employed in igniting compositions for matches is therefore impossible, though many unsuccessful attempts have been made to effect this substitution. We have discovered that by combining with the explosive compound referred to a suitable moderator said compound can be used as an igniting composition for matches with perfect safety and which will insure the ignition of the match stem or splint, and which can only be ignited by frictional contact with any suitable surface and which can be rendered practically proof against dampness. We have also discovered that ferro as well as ferri cyanids or compounds containing such will not only retard the combustion of an explosive compound such as above referred to to such a degree as will enable us to use such compound for heading matches, but will considerably modify its explosive character. Among other ferro and ferri cyanids experimented with we have found the following to give excellent results, to wit: Prussian blue, Turnbull blue, and the waste materials resulting from the purification of illuminating-gas, which latter materials, as is well known, contain ferrocyanid, together with sulfur, and contain, therefore, not only the moderating agent, but also a readily-inflammable slow-burning constituent—namely, sulfur—so that these waste materials are particularly well adapted to our purposes whenever the presence of sulfur in the composition is not objectionable. If carbon is used in lieu of or as an addition to the amorphous phosphorus in the explosive compound, we prefer to first treat the carbon with any suitable solution, so as to form on the carbon particles a waterproof or practically waterproof coating without thereby reducing the inflammability of such carbon. This we accomplish by treating the pulverized carbon, as charcoal, with a solution of nitrocellulose, whereby the particles of carbon are protected against saturation by the water of the aqueous solution of the binding agent, as glue or kindred agent, usually employed in igniting compositions for matches and which not only serves to bind together the constituents of said composition, but also serves to secure or bind the composition to the match stem or splint. The treatment of the carbon with a solution of nitrocellulose in acetic ether or in a mixture of ether and alcohol, according to the degree of nitration of the cellulose, can be readily effected in a closed vessel under constant stirring, after which sufficient heat is applied to evaporate the solvent, which can be recovered in a well-known manner by collecting and condensing the vapors.

In lieu of pulverized charcoal or in addition thereto other readily-ignitible carbonaceous substances—such as tinder, sawdust, lycopodium, and kindred substances—can be used, and in lieu of treating these substances with a solution of nitrocellulose for the purposes stated they may be treated with solu-

tions of other readily-inflammable substances insoluble in water—as, for instance, solutions of rosins, hydrocarbons, and kindred substances—although we prefer the nitrocellulose solution as more practical and producing better results. The inflammability of the composition can be increased by the addition of amorphous phosphorus to the mixture of explosive compound and moderator referred to.

We have found that by a mixture of from even forty to fifty parts, by weight, of potassium chlorate with from fifteen or even twenty parts, by weight, of amorphous phosphorus and a slow-burning carbonaceous substance, such as referred to, we can obtain a safe igniting composition for matches which is practically non-explosive and of a comparatively low degree of inflammability, which is not the case with a compound of amorphous phosphorus and potassium chlorate only. In lieu of or in addition to the potassium chlorate other oxygen-yielding substances can be used—as, for example, chlorates of other metals, perchlorates, chromates, peroxids, and the like.

In practice we mix with the igniting composition described a gritty substance, as pulverized glass, for well-known purposes, and, as previously stated, any suitable binding agent. The admixture of these constituents in a finely-divided state is effected by means such as are commonly used in the manufacture of igniting compositions for matches, the compound being of sufficient fluidity to admit of the heading of the match-splints by dipping in the usual manner, and this state of fluidity is obtained by suitably proportioning the solution of a suitable binding agent relatively to the dry constituents of the composition.

In the manufacture of matches as hitherto practiced and with a view to increase the inflammability of the match stem or splint these have been dipped into paraffin or equivalent substance for a certain portion of their length before being headed. In contradistinction to this process we first head the matches with our composition and then dip them into melted paraffin or equivalent substance for the purpose of practically waterproofing the match-heads, and this we are enabled to do, because even when coated with paraffin or like substance the composition will readily ignite by frictional contact, even with a more or less smooth surface, which is not the case with the compositions hitherto used because of the difficulty of igniting the same when so coated. Of course instead of paraffin other like substances, as other hydrocarbons or residues thereof and fatty substances, may be used.

The igniting compositions which we have found to give the best practical results and embody the requirements aimed at are the following: (*a*) five parts, by weight, of pulverized charcoal treated with nitrocellulose; fifteen parts, by weight, of Prussian blue; seven parts, by weight, of amorphous phosphorus; one hundred parts, by weight, of potassium chlorate; twenty parts, by weight, of pulverized glass, and a solution of a binding agent, as glue, sufficient to form a mass of the required fluidity; (*b*) twelve parts, by weight, of the waste material resulting from the purification of illuminating-gas; twenty-four parts, by weight, of Prussian blue; ten parts, by weight, of amorphous phosphorus; eighty-five parts, by weight, of potassium chlorate; twenty-five parts, by weight, of pulverized glass, and a solution of a binding agent, as above set forth.

It will be observed that all the constituents in the compound are rendered practically waterproof when the matches headed therewith are coated with paraffin or a similar substance.

We are aware that Prussian blue has been used before our invention in match compositions, but only as a pigment or coloring-matter for coloring the compositions. We, however, believe ourselves to be the first to make use of ferro or ferri cyanids or compounds of such as a moderator for the explosive and highly-combustible match-igniting compositions.

Having thus described our invention, what we claim as new therein, and desire to secure by Letters Patent, is—

1. An igniting composition for matches, containing an explosive compound of potassium chlorate and charcoal, treated with a readily-inflammable waterproofing substance, a retarder of combustion, and amorphous phosphorus, substantially as set forth.

2. An igniting composition for matches, containing an explosive compound of potassium chlorate and charcoal treated with a readily-inflammable waterproofing substance, a retarder of combustion, amorphous phosphorus and a coating of paraffin, substantially as set forth.

3. An igniting composition for matches, containing an explosive compound of potassium chlorate and carbon treated with a readily-inflammable waterproofing substance, a double cyanid amorphous phosphorus and a coating of paraffin acting as a friction-reducing and waterproofing substance, substantially as set forth.

4. An igniting composition for matches, containing an explosive compound composed of potassium chlorate and charcoal treated with a readily-inflammable waterproofing substance, a double cyanid, and amorphous phosphorus, for the purposes set forth.

5. An igniting composition for matches containing an explosive compound composed of potassium chlorate and charcoal treated with a nitrocellulose, a double cyanid, and amorphous phosphorus, for the purposes set forth.

6. An igniting composition for matches, consisting of an explosive compound, a waste product resulting from the purification of illuminating-gas and containing a double cyanid and sulfur, amorphous phosphorus, a gritty substance and a binding agent, substantially in or about in the proportions set forth.

In testimony that we claim the foregoing as our invention we have signed our names in presence of two subscribing witnesses.

JOHN LANDIN.
AUGUST JERNANDER.

Witnesses:
TH. WAWRINSKY,
M. GENBERG.