

UNITED STATES PATENT OFFICE.

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IGNITIBLE COMPOUND FOR MATCHES.

1,201,191.

Specification of Letters Patent.

Patented Oct. 10, 1916.

No Drawing.

Application filed March 25, 1912. Serial No. 686,126.

To all whom it may concern:

Be it known that I, GUSTAVE JONAS, a subject of the King of Belgium, residing at Brussels, Belgium, have invented a new and useful Improvement in Ignitable Compounds for Matches; and I do hereby declare the following to be a full, clear, and exact description of the same.

It is well known that up to the present time chlorate of potassium has been the principal base of the ignitable material made for the manufacture of safety matches having a special striking surface composed of red phosphorus, and this being so generally accepted, the use of the chemical appeared to be absolutely necessary for this kind of industry.

The question whether chlorates of other bases, or the perchlorates of metals other than potassium, could be employed in the manufacture of the ignitable composition for matches, was worth consideration. It is necessary however that the substances which enter into these compositions, must under no circumstances be hygroscopic. The chlorates of potassium and barium, with several others having costly metals as their base are the only ones which possess this advantage, and with these minute quantities of basic chlorates, such as those of copper, lead, etc., may be added with advantage in the preparation of the ignitable compound.

Chlorate of barium has been sometimes proposed as a substitute for chlorate of potassium in the manufacture of matches, but up till now it has not been a success as the inventors have not taken sufficiently into account the relative slowness of combustion of the mixtures of chlorate of barium, sulfur, resin, gum, etc. The presence of reducing agents such as the hyposulfites, polythionates, etc., certainly increases the sensitiveness to friction on any surface; but on a striking surface composed of red phosphorus, the match constantly crackles and only burns with difficulty, this being due to the presence of water of crystallization contained in the chlorate of barium.

It has been proved that a more rapid ignition and combustion of the composition on the end of the match may be obtained, when this contains a small percentage of a nitro-derivative, especially binitro- and trinitro-naphthalene, binitro-naphtoles, nitro-resin, or certain very inflammable substances like anthracene, pulverized gun cotton, etc.

Compounds of sulfur, phosphorus and other analogous substances, containing chlorate of barium as their base evolve a strong odor of chlorin and of chlorin oxid, when exposed to a temperature of about 35 degrees C., (or even when drying at an ordinary temperature). This singular property is specially noticeable in mixtures containing chlorate of barium, chromate of barium, sulfur, and other combustibles. It is manifested to a high degree in a perfectly neutral medium and even in a basic mixture. This is an extremely grave inconvenience capable in itself of rendering the application of chlorate of barium in the manufacture of matches commercially impossible, as it was difficult to obviate the necessity of the employment of sulfur or other analogous substances, which gave the required sensitiveness to ignition by friction.

It has been established that an addition of a slight percentage of cuprous sulfocyanate completely prevented the formation of chlorin and its oxids during the drying of those ignitable compounds having chlorate of barium for their base and containing sulfur or other analogous bodies. The cuprous sulfocyanate acts in a manner unknown as it undergoes no change through oxidation, a phenomenon which is easily verified owing to the change of color of this substance.

Instead of cuprous sulfocyanate, other cuprous compounds may be used, such as cuprous cyanid $\text{Cu}_2(\text{CN})_2$ which acts in a similar fashion to a cuprous sulfocyanate, but it is more difficult to prepare than the latter and is slightly less stable. Other cuprous salts act equally well as stabilizers (sulfites, sulfids, etc.), and even cuprous oxid may be used, but all of these com-

pounds are more unstable than the cyanid. It has also been found that the more insoluble mercurous salts of mercury also act as stabilizers, but at the same time they evolve a mercurial vapor while oxid of copper produced in the production of the paste remains in the ashes.

The specific gravity of the barium chlorate is considerably higher than that of chlorate of potassium, therefore the inflammable pastes prepared by the methods in actual use are much less voluminous when the chlorate of barium replaces the chlorate of potassium. For example, fifty matches prepared with an ignitable compound having for its base chlorate of barium, can easily contain a weight of dried ignitable material amounting to 1.63 grams, while with the inflammable mixtures containing chlorate of potassium this weight rarely attains 1 gram.

The difficulty arising from the heavier specific gravity of barium chlorate has been surmounted by taking advantage of the peculiar property of an ignitable compound which contains barium chlorate as a base of frothing or foaming when the ingredients of the base or ignitable compound are mixed directly together; that is, if the barium chlorate, glue and other pulverized substances making the base are mixed directly with the necessary amount of water. This foaming or frothing of the material is taken advantage of by first mixing the barium chlorate and the powdered substances of the paste with water, and afterward adding the glue. In this manner the foaming or frothing of the material becomes controllable, and this is especially true if a part of the pulverized ingredients or substances are reserved and mixed into the paste after the glue has been added. The paste thus obtained, due to the frothing or foaming of the substances when mixed with water, is filled with minute bubbles, and when the glue is added does not again settle to form a liquid completely free from bubbles, so that the matches when dipped into the paste will not for a definite volume of the substances, have a greater weight of material than the same volume of paste prepared with potassium chlorate as the base.

Owing to the peculiarity of the inflammable composition having chlorate of barium as its base of evolving chlorine freely, it is easy to understand that it is necessary to carefully avoid the presence of acid bodies in these compounds, and also that the use of bichromates is impossible. Only perfectly neutral chromates are admissible.

The following mixtures have given very

good results. The quantity of water to form the paste varies from 20 to 35% of the weight of the paste.

	I.	II.	III.	
Barium chlorate	50.0	40.0	50.0	70
Barium chromate	20.0	20.0	20.0	
Manganese di-oxid		10.0		
Lead peroxid or calcium plumbate	10.0	10.0	10.0	75
Ground glass	5.0	5.0	4.0	
Cuprous sulfocyanate	5.0	5.0	4.0	
Sulfur	2.5	2.5		75
Pulverized cotton	0.5	0.5	1.5	
Resin	2.0	2.0	5.0	
Gun cotton, pulverized			0.5	75
Tragacanth	5.0	5.0	5.0	
Glue				
	100.0	100.0	100.0	

Having fully described the nature of my invention, what I claim and desire to secure by Letters Patent is:—

1. In the process of preparing ignitable paste for the production of match heads, the step which comprises mixing a quantity of pulverized barium chlorate with the desired quantity of the non-adhesive constituents of the paste to be formed, adding water to the mass thus obtained, and then incorporating the adhesive constituents of the paste into the wet mass.

2. The process of preparing an ignitable paste for the production of match heads which consists in mixing a quantity of pulverized barium chlorate with the desired quantity of non-adhesive constituents of the paste to be formed, adding water to the mass thus obtained, then incorporating the adhesive constituents of the paste, then adding another quantity of the non-adhesive constituents.

3. In the process of preparing an ignitable paste for the production of match heads the steps which comprise mixing pulverized barium chlorate and cuprous sulfocyanate with the other non-adhesive constituents of the paste to be formed, adding water and then incorporating the adhesive constituents of the paste into the mass.

4. In the process of preparing an ignitable paste for the production of match heads the steps which comprise mixing pulverized barium chlorate and a cuprous compound insoluble in water with the other non-adhesive constituents of the paste to be formed, adding water and then incorporating the adhesive constituents of the paste into the mass.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

GUSTAVE JONAS.

Witnesses:

S. OAKSLY,
CHAS. ROY NASMITH.