

Oct. 4, 1949.

S. J. McCLUNG

2,483,589

METHOD OF PRODUCING EXPLOSIVE COMPOSITIONS

Filed Feb. 23, 1946

Fig. 1.

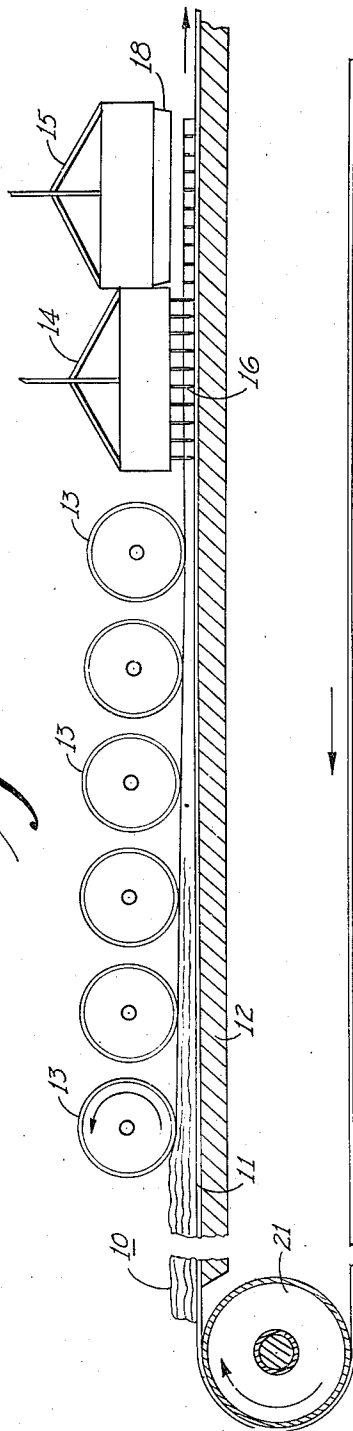
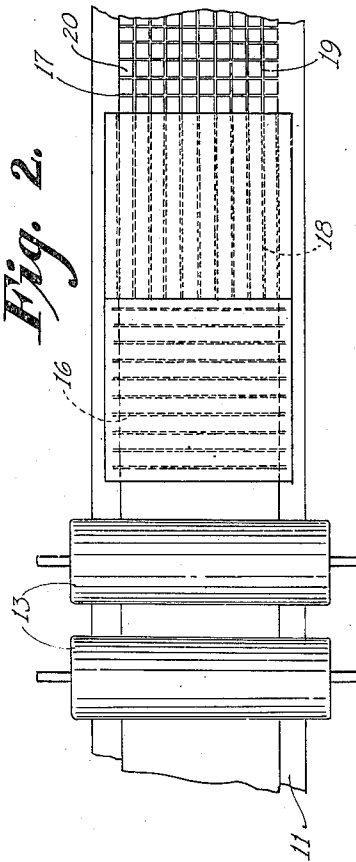


Fig. 2.



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UNITED STATES PATENT OFFICE

2,483,589

METHOD OF PRODUCING EXPLOSIVE COMPOSITIONS

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Application February 23, 1946, Serial No. 649,724

1 Claim. (Cl. 52—21)

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My invention relates to an explosive composition and more particularly to such a composition having a controlled burning time. This composition may be used as a propellant for projectiles in a closed chamber, such as the firing chamber of a gun, or in other types of projectiles such as a rocket.

The composition of my invention is one in which an oxygen liberating material is combined with a fuel material to produce large volumes of combustion gases, and obtain a marked improvement in efficiency of the projectile. The desirable results are obtained by an improved procedure that I have developed for combining the several components of the composition.

A feature of my invention is the production of the explosive composition first in sheet form and then cutting this sheet into squares or other shapes of the desired size.

Another important feature of my invention is the impregnating of a portion of the explosive composition with an especially prepared hydrocarbon material that penetrates and fills the structure of this portion and renders the composition markedly improved over related prior art compositions.

The composition of my invention comprises, a portion of resin impregnated potassium chlorate, which functions as the advanced oxidizing agent; and another portion of potassium chlorate impregnated with the above mentioned hydrocarbon material and mixed with pulverized charcoal, to provide the power component of the composition. These two separately prepared portions are subsequently combined with a suitable combustible binder, such as collodion, and the complete composition dried to a dough-like mass, sheeted and then cut into small individual pieces as above mentioned.

Instead of the potassium chlorate, other known oxygen liberating salts, such as per chlorates, nitrates, etc., may be used. And chemical equivalents of potassium chlorate, for the purposes of this invention are contemplated by the use of the term herein.

The pulverized charcoal or equivalent is desirable for obtaining a more uniform mixture of the potassium chlorate and hydrocarbon material. Also, it serves as an additional absorbent of the hydrocarbon and its black color serves as a color indicator for thorough blending of the components of the composition.

For the above mentioned resin impregnated portion of potassium chlorate, any suitable, oil resistant, inflammable resin may be used, par-

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ticularly the natural resins. An example of one that I have found very satisfactory is a natural resin found in the Philippine Islands and known commercially as "Manila Copal." It is soluble in ether-alcohol solution and serves the purpose of impregnating and coating the selected portion of the potassium chlorate so that it will not absorb the hydrocarbon that is incorporated in another portion.

This resin impregnated potassium chlorate is a fast burning material and the rate of combustion of the entire composition is determined by regulating the proportions of this part of the composition to the other part, which is slow burning because of the hydrocarbon impregnant, and which is prepared by the following special procedure.

An hydrocarbon material, for example paraffin, having a melting point of about 120° F., which is therefore solid at normal atmospheric temperatures, is mixed with an hydrocarbon distillate, e. g. a good grade of refined, commercial gasoline, in about equal proportions. This mixture is then distilled and the distillate consisting of a solution of paraffin and gasoline therefrom used for impregnating the portion of potassium chlorate. The impregnating treatment is carried out a little above atmospheric temperature but below the temperature at which the potassium chlorate will begin to expand. This is a very important feature of my invention since I have discovered that it is necessary to heat the potassium chlorate gently but sufficiently to drive off atmospheric moisture; yet at the same time to avoid heating the potassium chlorate at a temperature sufficiently high to cause it to expand. If this expansion takes place, I have found that the potassium chlorate will not absorb the hydrocarbon, as desired. Depending upon local atmospheric conditions, this temperature will vary from about 70° F. to 100° F.

An illustrative but non-limiting example of the composition and procedure characteristic of my invention is as follows:

Advanced oxidizing agent

A portion of potassium chlorate is powdered and dried at a low temperature, e. g. 100° F. Two parts of this dry powder are then impregnated with three parts of the above ether-alcohol solution of Manila Copal resin. The resin impregnated potassium chlorate is then dried at low temperature, e. g. about 100° F. with agitation to produce a dry powder. On a dry weight basis this powder contains approximately 2 parts of potassium chlorate and 1 part of resin.

Fuel or power material

Another portion of potassium chlorate is dried and powdered as described in the preceding paragraph, and to the dry powder is added $\frac{1}{8}$ part of pulverized charcoal. This mixture is next impregnated with the above described distillate from 1 part each of paraffin and gasoline and the resulting impregnated material dried slowly at about 10° F. above room temperature. The use of the above distillate effects thorough penetration and impregnation of the potassium chlorate with the hydrocarbon distillate. This distillate is heated to about 100° F. for the impregnation treatment and when it cools to room temperature the hydrocarbon distillate is deposited as a solid impregnant throughout the mass of the potassium chlorate.

Complete composition

The complete composition is now produced by mixing the following:

	Parts
Dried resin-impregnated potassium chlorate	$\frac{1}{4}$
Dried, hydrocarbon distillate-impregnated potassium chlorate and charcoal	$1\frac{7}{8}$
Collodion	8

The resulting mixture is dried by slow evaporation of the solvent in the collodion, at a temperature of about 80° F., until the mass is of about the consistency of baker's dough. This mass is then extruded or sheeted for cutting up into "grains" or pieces and dried at about 80° F. until it turns a gray color.

The above collodion constituent of the complete composition serves not only the conventional purpose of a binder for effecting cohesion of the composition, but also serves the very important purpose in accordance with my invention of controlling the burning of the hydrocarbon distillate constituent of the composition. This control is obtained by using a substantially larger amount of the collodion than is normally used for binder purposes. This new function of the collodion in my composition prevents the hydrocarbon distillate constituent from becoming heated too rapidly and melting and receding from the potassium chlorate. In other words, the relatively large amount of collodion, or similar binder used, serves as a heat buffer and absorbs the applied heat so that the hydrocarbon distillate will be heated at the desired controlled rate with respect to the potassium chlorate.

A typical product prepared in this manner and which I have found very satisfactory for use as the explosive charge for projectiles may have the following parts and constituents:

2 ozs. potassium chlorate filled with
1 oz. of resin
16 ozs. of potassium chlorate and
2 ozs. charcoal together filled with
12 ozs. of the special hydrocarbon distillate.

I have found that most of the prior art explosive compositions tend to crumble up when extruded or sheeted and are not easily adaptable for cutting or forming into pieces, grains or particles of substantial, uniform size. However, when using the above type of composition and process of manufacture, I have been able to obtain a product which is easily cut into uniform, individual squares or any other desired shape, and the cut pieces can be handled satisfactorily without crumbling.

When desired, the relative positions of the two

cutting devices 14 and 15 may be reversed so that the composition 10 will be cut first longitudinally and then transversely.

A mechanical arrangement suitable for sheeting and cutting the composition of my invention is illustrated in the accompanying drawing, in which:

Fig. 1 is a longitudinal side view, partly in section, of the sheeting and cutting assembly; and

Fig. 2 is a plan view of the right end portion of Fig. 1.

Referring more specifically to the drawings, the composition 10, prepared as described above, is placed on a moving belt 11 which is in turn supported by a frame 12. Located along the length of the belt and extending transversely across the width thereof and at gradually decreasing heights above the belt, are a series of pressure rolls 13. Following these rolls 13, are two cutting devices 14 and 15 for cutting the sheeted composition into individual squares of desired small size. The knives 16 are located transversely across the width of the belt and produce the transverse cuts 17 in the sheeted material, as shown in Fig. 2. The knives 18, in the cutter 15, are located longitudinally along the length of the belt 11, and produce the longitudinal cuts 19. This system of cuts produces individual squares 20 of the final composition.

The belt 11 is moved by power driven rolls 21, located at the respective ends of the sheeting and cutting assembly, only one of these rolls being illustrated in Fig. 1. The sheeting of the composition 10 is effected by means of the gradually increasing pressure thereon of the rolls 13, it being apparent that the spacing of these rolls from the belt 11 may be varied to give the desired thickness of the final sheet. The cut squares of the composition 20 may be removed from the belt, following the cutting device 15, by any suitable means, such as a conventional doctor blade located at the end of the run of the belt, that is, where the belt reverses direction around the right end roll and returns to the starting point.

As will be understood from the foregoing, my invention is concerned principally with the production of an explosive composition having a burning rate controlled by the requisite proportions of liberatable oxygen from the potassium chlorate, and fuel from the hydrocarbon material; and which composition is adaptable for cutting up into uniform pieces. I have found that the control of the burning rate is largely determined by the nature of the contact between the hydrocarbon fuel and the potassium chlorate or other oxygen liberating salt. Also, I have discovered that such control can be best effected by impregnating a portion of the potassium chlorate with a suitable hydrocarbon which retards the normal burning rate of the potassium chlorate; and impregnating the remaining portion of the potassium chlorate with a resin, which is combustible and will resist penetration of this portion of the potassium chlorate by the hydrocarbon material, and thereby permit this resin treated portion to burn rapidly. Now, by combining in proper proportions the slow burning, hydrocarbon-impregnated portion of potassium chlorate, the desired burning rate and type of progressive burning to give maximum explosion efficiency can be obtained. The burning rate of the composition is increased by increasing the relative proportion of the fast burning, resin-impregnated potassium chlorate; and the burning rate is decreased by increasing the relative

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proportion of the slow burning, hydrocarbon-impregnated potassium chlorate.

This application is a continuation-in-part of my application Serial No. 452,236, filed July 24, 1942, now abandoned.

Various modifications and substitutions may be made in the foregoing materials and methods as contemplated by the scope of the appended claim.

I claim:

A method of making an explosive composition comprising mixing paraffin and gasoline in equal proportions, distilling this mixture under conditions to effect a liquid distillate consisting of a solution of paraffin and gasoline, drying a portion of potassium chlorate at a temperature from between about 70°-100° F. by a gentle heating thereof to drive off atmospheric moisture but insufficient to cause the potassium chlorate to expand, mixing pulverised charcoal with the dried potassium chlorate, then impregnating this mixture with said paraffin-gasoline distillate at about 100° F., and slowly drying the resulting impregnated material at a temperature about 10° F. above room temperature; drying a second portion of potassium chlorate at a temperature between from about 70°-100° F. by a gentle heating thereof to drive off atmospheric moisture but insufficient to

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cause the potassium chlorate to expand, impregnating this portion of potassium chlorate with a volatile solvent solution of manila copal resin, and drying the impregnated potassium chlorate at a temperature of about 100° F. to produce a dry powder; then mixing the dried resin-impregnated potassium chlorate with the distillate impregnated potassium chlorate and charcoal mixture, adding a plasticized nitrocellulose binder to unite the mixtures and slowly drying the bonded mixture until the mass is about the consistency of baker's dough, sheeting the mass and cutting into small pieces or grains and drying the same.

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REFERENCES CITED

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

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4,507	Great Britain	1899
31,786	Germany	June 15, 1885

Certificate of Correction

Patent No. 2,483,589

October 4, 1949

SIDNEY J. McCLUNG

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 4, line 69, after the word "chlorate" and before the comma insert *with the fast burning resin impregnated portion of potassium chlorate*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 3rd day of January, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.

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[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.