L. GRAY.

PROCESS OF MANUFACTURING AN EXPLOSIVE COMPOUND.

APPLICATION FILED OCT. 15, 1909.

967,185. Patented Aug. 16, 1910.

Fig. 1.

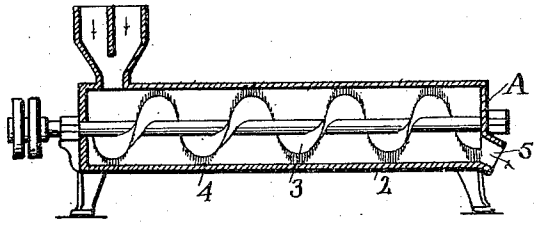


Fig. 2.

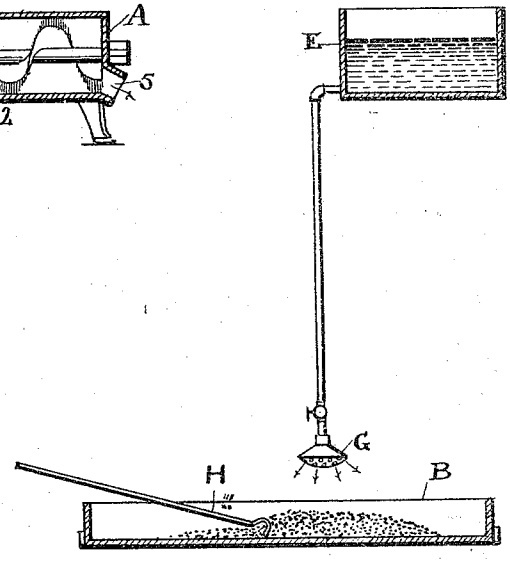
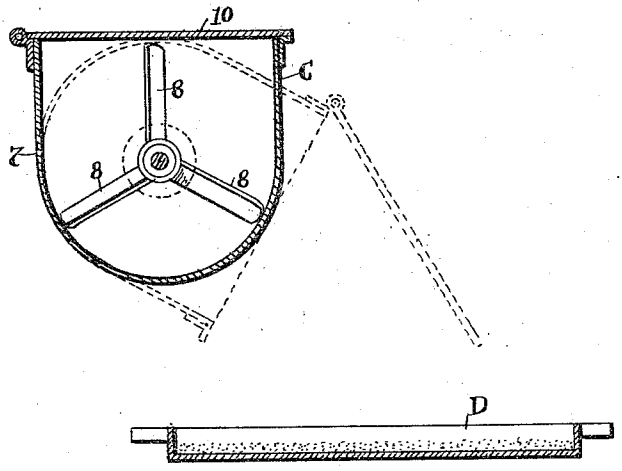


Fig. 3.



ATTEST

E. M. Fisher

F. C. Museum.

INVENTOR

LOFTUS GRAY.

BY Fisher & Moore

ATTYS.

UNITED STATES PATENT OFFICE.

LOFTUS GRAY, OF CLEVELAND, OHIO.

PROCESS OF MANUFACTURING AN EXPLOSIVE COMPOUND.

967,185 Specification of Letters Patent. Patented Aug. 16, 1910.

Application filed October 15, 1909. Serial No. 522,793.

To all whom it may concern:

Be it known that I, LOFTUS GRAY, citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Processes of Manufacturing Explosive Compounds, of which the following is a specification.

My invention relates to a process of manufacturing an explosive compound consisting for the most part and essentially of sugar and chlorate of potash mixed and granulated and prepared for the market substantially as set forth in my application for Letters Patent of the United States Ser. No. 510,583, covering the compound as a finished article of manufacture and sale. The invention herein has to do exclusively with the method of manufacturing of the said article, all substantially as shown and described and particularly pointed out in the claims.

In the accompanying drawings Figure 1, is a longitudinal sectional view of a dry mixing apparatus, Fig. 2 is a similar view of my wet mixing apparatus and Fig. 3 shows sectional views of my granulator and drying pan.

The several devices represented in the plant thus shown also represent the several necessary and successive steps in the manufacture of the compound, and it will of course be understood that the said devices are designed more particularly to indicate the character of the instrumentalities that may be employed in carrying out the manufacture rather than an arbitrary showing of the exact and only means adapted to be used for this purpose, and hence it should be understood that the means may be greatly varied or entirely changed in form and be within the scope and spirit of my invention, the several steps represented in and by said devices successively being of the essence of the invention and not the devices themselves. As to these steps in the manufacture, account has to be taken both of the constituents of the compound and the form of the ultimate product produced by their union, and also of the dangers attending the manufacture of the explosive.

Referring first to the materials or ingredients employed, it is to be observed that I use say equal parts of sugar and chlorate of potash, or more or less of each within limits as may be found sufficient, and the first step in the manufacture is to mix these ingredients in a dry state. I say dry advisedly because it is impossible to obtain a thorough and uniform admixture of two such easily melted and sticky substances as sugar and chlorate of potash in any other way unless they be dissolved to a liquid form. My first essential step therefor is dry mixing of these ingredients and for this purpose I show a mixer A. This device has a cylinder 2 and a power driven worm 3 with brushes 4 on the edge of the worm to contact with and cleanse the wall of the cylinder, and the discharge is at 5 at the end of the cylinder. Obviously any equivalent means of mixing the dry ingredients may be used. Now, having the ingredients mixed in a dry state as thus described they are ready for the next step in the manufacture and which contemplates the granulation of the material to a commercial form. This may be subdivided for convenience of understanding into two related steps or what may be termed the gumming of the mixture and its granulation. In the first of these two latter steps a third ingredient is introduced which is indispensable to the product in a commercial or usable sense, or as I place it upon the market, though it does not presumably contribute to the explosiveness of the compound as such. Possibly this is underestimating the real value of this third ingredient because its actual or visible value is to produce granulation or a granular form of the product, and I have found that it is in this form only that the essential explosive power of the mixture is possibly obtained. For example, if a binder of a cohesive character or quality like gum arabic be not employed so as to effect granulation by a fixed union of particles the product simply falls down or disintegrates when the moisture evaporates, unless it melts the ingredients together, and that makes a different product. This may be demonstrated by moistening the dry mixture with a percentage of pure water. Hence a binder which will convert the mixture from an otherwise mixed but unfixed state into a union with granulation and hold the mixture firmly in that form for sale and use does actually contribute to the explosive values and become an indispensable element in and to the compound. The second step in making the compound may, therefore, be regarded as the cohering or affixing step in the progress of manufacture, the slight

amount of water used being merely as a vehicle to distribute and apply the adhesive or binder and which is fundamentally essential to granulation in a moistened state. This step has its demonstration in the mixing box or receptacle B in conjunction with the dampening tank E and sprinkler G. Ordinarily the primary or dry mixing in cylinder A proceeds regardless of connection with the next succeeding step, and the discharge therefrom at 5 may be to any suitable place or even on a different floor from mixer B. This makes mixer B independent of said cylinder and contemplates a step in the process which is peculiar to itself as such. To this end and to illustrate a simple and practical way of doing the work I show a hoe H as the medium for mixing the substance while it is being dampened by the adhesive solution from tank E. This solution by preference consists of say three to four ounces of gum arabic to a barrel of water or in some such proportion, and if any equivalent adhesive were employed in lieu of gum arabic ordinary skill and judgment based upon tests and experience would tell what amount should be used. For a more simple practice than that shown an ordinary sprinkling can can be used, but the application of the moisture must be attended by the stirring of the material, and indeed a fine mist or spray for dampening is better still because with a material so soluble or susceptible to moisture as this mixture is the tendency is to form lumps or chunks, and these when dry are almost impossible to break. In fact a block of the material that is more or less run together and dried will become so hard and tenacious that it cannot be crushed without very great effort and danger of explosion and fatal consequences. I therefore deem it a very important discovery that granulation of this mixture can be accomplished through a moistening process which will yield a granular product, and the secret of this of course lies not in the dampening as such but in using it as a medium for applying just the right quantity of a binder that will yield permanent granulation when applied in the presence of a sustained agitation and until a uniform distribution of the binder is obtained. The condition at which this is best done is between the perfectly dry and the melting or caking of the mass. A hoe is a thoroughly good implement with which to conduct this work as it is easily applied where most needed and easily cleaned, and the sprinkler G serves to illustrate the application of the solution while stirring proceeds. The next or third step in the process is to bring the material to a uniform granular state preparatory to drying. Of course granulation has already been begun in mixing box B, in which the gummy solution has adhered the otherwise loose particles of the original ingredients into accretions or granules of relatively small size, for there is not sufficient moisture nor adhesive to make large lumps nor to bind the particles together into anything like a sticky mass. Yet granulation is not obtained in box B as required and hence the next step is represented in and by the device shown at C. This device comprises a trough 7 and an agitator having arms or fingers 8, or their equivalent, and which are adapted by rotation to reduce the material to a strictly granulated condition ready to go to the drier. When this is done the said trough or receptacle C is emptied into drying pans D, whence the material is removed to the drying room and thoroughly dried. This completes the manufacture, and then if found desirable the material may be run through a separator and assorted according to grades of fineness wanted and the use to be made thereof.

The arms or fingers 8 may have any suitable form and be revolved at any rate that will best promote the end in view, and a lid 10 is preferably provided for the receptacle to prevent escape of the finer and dust like particles and possible ignition from external causes. Otherwise the material is moist enough to prevent danger from internal ignition. Friction is avoided in the dry mixer by the brushes 4.

Granulated sugar is preferred but any kind may be used. The degree or amount of moisture present in the sugar should be considered when it comes to adding moisture to mixing receptacle B but the drier the better, and the quantity of gum or binder to a given amount of water will also be considered in connection with the state of the sugar as to moistness. No hard and fast rules can be laid down as to these details, but by following the description herein and with ordinary skill and judgment the explosive will be produced in its most effective form.

I have laid stress upon the use of an adhesive substance of a suitable kind for the mixed but otherwise unincorporated or uncombined original elements of sugar and potash because such a substance is indispensable to the granulation of these two ingredients in such manner that granulation shall become fixed in the finished product. Drying in lumps which afterward have to be crushed for use I utterly disclaim for the obvious reason that by melting the ingredients to get the more or less solid and lumpy condition the original particles in the ingredients are dissolved and run together and the product not only changes its essential character from a merger by adhesion to a coalescence or mass, but the violent means unavoidably necessary to reduce such a solidified mass to a crushed state is at-

tended by extreme peril to life and property.

The present case has to do exclusively with the process of manufacturing my new and improved explosive compound, and the composition of the explosive as such, or the article which is the product of the within process, is the subject matter of an application for Letters Patent filed by me on the 31st day of July, 1909, and bearing Serial No. 510,583.

What I claim is:

1. The method herein described of manufacturing an explosive compound containing chlorate of potash and sugar by first mixing these elements intimately in a dry state, then secondly, spraying a solution of an adhesive upon the dry mixture and at the same time stirring it to prevent coagulation and until the requisite quantity of liquid is applied to produce a coarsely granulated product, thirdly, continuously stirring the product of the second step in a closed vessel while still moist until a finer and complete granulation is accomplished, and finally drying the product as mixed and granulated by the preceding steps.

2. The method described of making a granulated explosive compound containing sugar and chlorate of potash by intimately mixing these elements together in a dry state in a dry mixer in substantially equal proportions, then spraying a solution of an adhesive in a fine mist upon the mixed product while in an open vessel and at the same time stirring it until a desired amount of liquid is thus uniformly applied to produce a coarsely granulated product, then stirring this coarse product in a second vessel by mechanical means and while still moist until a uniform finer granular state thereof is obtained, and finally drying the product as granulated by exposure to heat.

In testimony whereof I affix my signature in presence of two witnesses.

LOFTUS GRAY.

Witnesses:
F. C. MUSSUN,
E. M. FISHER.