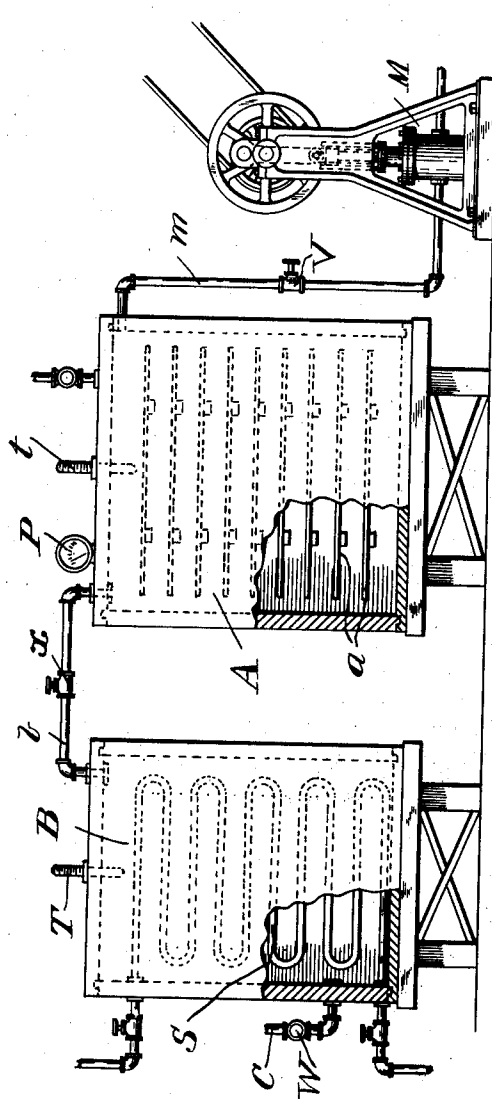


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PATENTED DEC. 17, 1907.

G. W. VOLNEY.
MANUFACTURE OF GUNPOWDER.
APPLICATION FILED JUNE 22, 1906.



Witnesses:

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MANUFACTURE OF GUNPOWDER.

No. 874,264.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, CARL WALTER VOLNEY, a citizen of the United States, residing in Keyport, in the county of Monmouth and State of New Jersey, have invented certain new and useful Improvements in the Manufacture of Gunpowder, of which the following is a specification.

My invention relates to that class of gunpowder which has, as a constituent, cellulose nitrates in a colloid state. In its manufacture the cellulose nitrates are commingled with certain volatile liquids, such as mixtures of ethyl alcohol and ether, alkyl acetates, acetone and kindred so called solvents, combining therewith and forming a colloid mass which is subsequently pressed into suitable shapes, such as sheets, cubes, cylinders and prisms; these pressed masses then undergo a finishing process which has for its purpose the induration or hardening without disintegration of these masses and the removal of the so-called solvents therefrom.

It has been found in practice that the removal of volatile matter from the pressed masses of the above described gunpowder is difficult and tedious. Under the present practice of finishing such gunpowder, the removal of so-called solvents by drying and the indurating of the pressed masses begins on their surface, which becomes incrustated with a horn like covering; the further removal of solvents and the indurating of the pressed bodies progresses from the surface towards the interior of the masses, and if these masses are of large dimensions, an uncertain and nearly undeterminable length of time is necessary for a complete finishing of the process. On the other hand, the complete finishing of the process; that is, the entire removal of all volatile, extraneous matter and perfect and homogeneous induration of the pressed powder masses is absolutely necessary, for thereon depend the uniformity and lasting stability of the ballistic qualities of the hereinbefore described class of gunpowder.

It is well known that small quantities of volatile matter, such as alcohol, ether, alkyl acetates and acetone, retained in the pressed powder masses under the indicated circumstances, change the ballistic qualities; it is, however, not equally well known but open to proof, that the presence of these so-called solvents and the subsequent incomplete

drying and induration, tend to an absorption and retention of atmospheric moisture, whereby the colloid nature of the cellulose nitrates is changed into a brittle, disintegrating mass which does not indurate in the manner of the usual colloid, and is extremely liable to change the gunpowder into a detonating explosive on being fired in the usual manner. At the same time the application of heat, which overcomes the indicated drawbacks, can, under the present practice of treating this class of gunpowder, be of limited use only, as thereby the surfaces of the masses merely are exposed to the effects of heat, tending to dangerous overheating before penetrating deeper into the mass; the extreme effective application of heat is prohibited by the explosive nature of the material.

It is the purpose of my invention to overcome the herein cited difficulties and to produce gunpowder free from extraneous and unstable matter, such as the solvents mentioned, and of the uniform homogeneous induration desired. To that end I do not follow the present practice in the use of drying rooms, vacuum drying chambers and currents of heated or dry air, as by all these at present used means the surfaces of the masses only are heated, the volatile matter removed from the surfaces only and the pressed masses indurated on the surfaces merely, leaving the interior to a long continued and uncertain drying out, of dangerous proclivity. For this purpose I use any suitable gas, preferably atmospheric air of a desired temperature; by varying the pressures in the interior of the powder masses and the outside gas or air, preferably slightly warmed, the gas is forced to enter the masses through interstices, and capillary fissures, also by an osmotic action; thereby producing ultimately a uniform temperature throughout these masses. The vapor tension of the volatilizing matter in the interior is increased and its diffusion with the surrounding air or gas facilitated; and by these means the combination of the volatile matter, especially that of ethyl alcohol with the cellulose nitrates, ceases and the desired uniform induration of the powder mass is completed. Upon decreasing the pressure of the air surrounding the powder grains, the air forced into the interior of the masses is withdrawn therefrom with its diffused volatilized matter, and in such manner the powder is

rendered free from changeable matter and at the same time uniformly indurated.

To carry out the hereinbefore described improvements, I use a suitable reservoir for
 5 keeping gas or atmospheric air under normal atmospheric pressure, and at a temperature of about 35° C. It is connected with a drying chamber which can be used under a vacuum of 70 or 80 millimeters below atmos-
 10 pheric pressure, and receive the gunpowder to be treated; an air pump for producing partial vacuum of about 70 millimeters below normal, is connected with the vacuum chamber. After placing the pressed powder
 15 in the usual manner in the vacuum chamber, as for instance on shelves, the partial vacuum is produced, and then the chamber filled with air or gas of preferably about 35° C. temperature and normal atmospheric pressure, whereby the pressure in the powder
 20 chamber rises to that of the atmosphere. After leaving the warm air in contact with the powder for the space of about one hour, the chamber is again connected with the air
 25 pump, and again a reduction in pressure of 70 millimeters produced therein, and the connection with the air reservoir again opened and air at 35° C. admitted. This
 30 plan of withdrawing and admitting air at comparatively long intervals is repeated, until test shows the withdrawn air to be free from volatile matter, which indicates the finishing of the process.

The heating of the air may be effected in
 35 any desired manner, as, for instance, by steam radiating apparatus, the hot air collected in the reservoir and by admission of cool air brought to a temperature of about 35° C.; the air reservoir is connected by one
 40 or more pipes with the vacuum chamber, which can thus be placed in a conveniently isolated situation. As the temperature in the air reservoir can be automatically regulated to 35° C., overheating of the gunpow-
 45 der is avoided, and as it is the only source of heat in the vacuum chamber the described operations insure the desired safety.

In the drawing is illustrated an apparatus suitable for carrying out the present process.
 50 The powder or other material to be dried may be placed on shelves *a* in a closed reservoir A; which reservoir is provided with a thermometer *t* and a pressure gage P. Any suitable pump M is connected by a pipe *m*
 55 with the vessel A, the pipe having a valve *v*. The air or other gas is admitted to the reservoir A from a closed reservoir B through a pipe *b* provided with a valve *x*. The reservoir B is shown provided with an inlet pipe C
 60 provided with a valve *w*. Suitable means are provided for heating the air in this reservoir B, coil pipes S being shown as arranged in the reservoir that may be supplied with steam or other suitable heating medium to
 65 warm the air in this reservoir, the tempera-

ture of which is indicated by a thermometer T projecting from the top. The powder or other material is placed on the shelves, and the two valves *v* and *x* are opened and the pump started, that will draw out the air
 70 from the reservoir A and draw in the heated air from the reservoir B, that is preferably heated to a temperature of about 35° C. Thereupon the valve *x* will be closed and the reservoir A will be exhausted, preferably to
 75 reduce its pressure about 70 m. m. Thereupon the valve *v* is closed and the powder allowed to remain in the reservoir A for a considerable length of time, preferably about one hour. Thereupon the valves *x* and *v*
 80 are opened and the air drawn out of the reservoir A and replaced with a fresh quantity of air from the reservoir B. Thereupon both valves are closed and the powder is subjected to this heated air at the normal atmospheric
 85 pressure, preferably for about one hour. These treatments are alternated in the described manner until the air withdrawn by the pump from the reservoir A is found to no longer contain volatile matter, when the
 90 powder will be thoroughly dry.

By the described treatment of the herein indicated class of gunpowder, having for a constituted part or being wholly composed of cellulose nitrates in a colloid state, the
 95 powder is rendered free from any volatile matter; the drying and indurating takes place homogeneously throughout the pressed powder masses; and thereafter absorbed atmospheric moisture has no effect on the powder thus treated to change its ballistic prop-
 100 erties.

By the methods heretofore in use comparatively long periods of time were required to dry the powder, involving weeks and
 10 months. Whereas by my process less than the time of twenty-four hours is necessary, to effect a practically perfect drying and removal of the solvents, while with the old lengthy processes the interior was not
 110 treated, and the remaining solvent portion in the masses, of uncertain and varying quantities, resulted in changing the composition, and hence the ballistic properties of the powder, so that a powder tested and
 115 stated to be of a certain explosive character would after a period of time vary such property and become detonating, with disastrous results. After being treated by my process the ascertained firing qualities of a powder
 120 remain constant and unchangeable for any period of time.

By the term "air" as employed in the claims it is to be understood that any kind of absorptive atmosphere; that is, any gas,
 125 simple or compound, or an admixture of gases, can be used, that will not have a deleterious action on the cellulose nitrates, or similar materials constituting the powder masses, during the time required for the
 130

process. The atmospheric air for economic reasons is found very desirable. But any other gas could be substituted that would not injure the powder.

5 While it has been found desirable to make the intervals of the alternations of pressure about one hour, this can be lengthened or shortened within considerable limits. But the intervals should be of comparatively
10 long duration, that is, they should not be rapid fluctuations, such as might be caused by a continuously acting pump or valve mechanism connected therewith.

Having thus described my invention, I
15 claim:—

1. In the art of finishing powder containing cellulose nitrates with alcohol and ether as solvents, the process of removing the alcohol and ether, consisting in subjecting
20 the powder in a closed vessel to air heated to about 35° C. at normal pressure, and alternately subjecting the powder in the closed

vessel to air heated to about 35° C. with the pressure reduced about 70 m. m., said steps being each continued for a considerable 25 length of time.

2. In the art of finishing powder containing cellulose nitrates with alcohol and ether as solvents, the process of removing the alcohol and ether, consisting in subjecting 30 the powder in a closed vessel to air heated to about 35° C. at normal pressure, and alternately subjecting the powder in the closed vessel to air heated to about 35° C. with the pressure reduced about 70 m. m., said steps 35 being each continued for about the period of one hour.

Signed at Nos. 9 to 15 Murray street, New York, N. Y., this 21st day of June, 1906.

CARL WALTER VOLNEY.

Witnesses:

WILLIAM H. REID,
JOHN O. SEIFERT.