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PROCESS AND APPARATUS FOR MANUFACTURE OF SMOKELESS POWDER

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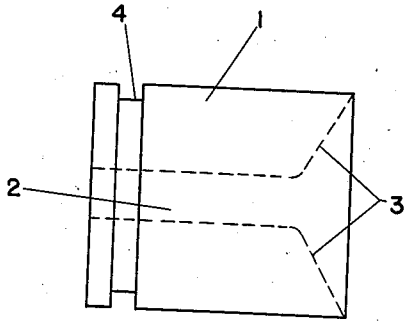


FIG.-1

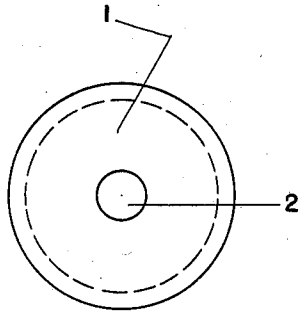


FIG.-2

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PROCESS AND APPARATUS FOR MANUFACTURE OF SMOKELESS POWDER

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7 Claims. (Cl. 18—47)

This invention relates to an improved process of manufacturing colloided smokeless powder, and more particularly to an extruding die for smokeless powder which is resistant to the abrasive action of the powder.

Heretofore, in the manufacture of smokeless powder, nitrocellulose has been colloided by the use of solvents, for example, ethyl alcohol-ethyl ether or acetone-ethyl ether mixtures to a dense colloid, and, if desired, with the addition of a liquid explosive such as, for example, nitroglycerine or the like. This plastic colloid has been extruded through dies to form strands of the desired diameter which may, if desired, have one or more central perforations therein and the resulting strands cut into grains.

The object of this invention is to provide a die for use in extruding smokeless powder that is resistant to the abrasive action of the powder. A further object of this invention is to provide a die that will alleviate the need of continually changing dies used in the extruding of smokeless powder strands. Further objects will appear hereinafter.

In the manufacture of smokeless powder the dies through which the plastic colloid is pressed have been made heretofore of hardened steel. I have found that when dense colloided smokeless powder is made up using, instead of fresh fibrous nitrocellulose, a ground or otherwise disintegrated scrap smokeless powder suitably softened to a plastic colloid by the use of solvent mixtures, such as ethyl ether-ethyl alcohol or ethyl alcohol acetone, an extreme wear of the hardened steel dies occurs. For example, when pressing 285 pounds of colloided smokeless powder through a steel die into a 155 mm. howitzer powder strands, the die enlarged from .0675 to .0720 inch, thus rendering the die useless and requiring frequent and costly replacements. Harder steel is not favorable on account of brittleness and lack of strength, but much to my surprise I have found that I may use a comparatively soft metal and produce a die that has many advantages over the hardened steel dies.

Having now indicated in a general way the nature and purpose of this invention there follows a more detailed description of the preferred embodiment thereof, with reference to the accompanying drawing in which: Figure 1 is an elevation view of a die and Figure 2 is a plan view of the die of Figure 1.

The die 1 of this invention is constructed of stainless steel, having a composition comprising about 84 to 86% iron, 13 to 14% chromium, .2 to .4% carbon, and .3 to .5% manganese, and contains a single hole 2 centrally located within the body of the die. The die 1 is of heavy construction to withstand the pressure necessary to cause the smokeless powder colloid to extrude through the hole 2. The die 1 is designed to have a funnel shape entrance 3 to the die hole 2, as this type design greatly facilitates the extrusion operation. The groove 4 which extends around the die 1 is so placed to aid in maintaining the die in an adapter, now shown. The type press, in which the die is to be used, will determine the type adapter necessary and since this procedure is well within the skill of the art the press and adapter are not depicted.

The die 1 of this invention as will be obvious to those familiar with the art may be fitted with pin to produce perforated powder grains if so desired and this pin will be included as part of the adapter.

Now in accordance with this invention I have produced a die from a comparatively soft metal which has a composition of approximately 85–86% iron, 13–14% chromium, .2–.4% carbon, .3–.5% manganese, .1–.3% silicon with traces of phosphorus and sulfur, and about a 97/98-B Rockwell hardness. Alloys of approximately the above composition and properties are sold under the trade names of "Anum Metal" and "Carpenter Stainless #2." It is to be noted that the hardened steel dies now in use have approximately 56/57-B Rockwell hardness which on a comparative basis would class the die metals of this invention as very soft.

It is wholly unexpected and unpredictable that a comparative soft metal would have a longer life and withstand the abrasive action developed in pressing smokeless powder better than the hardened steel dies, but that such is the case is apparent from the results shown in the table below.

Table

Metal used	Diameter of die		Enlarged
	New	After extruding 285 lbs. powder	
	Inches	*Inches*	*Inches*
Hardened steel	.0675	.0720	.0045
Soft steel*	.0675	.0679	.0004

*Composition approximately 84–86% Fe, 13–14% Cr, .2–.4% C, .3–.5% Mn, .1–.3% Si, and traces of P and S and with a Rockwell hardness of about 97/98–B.

It is noted from the table that the life of a die

made from the soft metal of this invention would be approximately eleven times that of the hardened steel dies now in use. Such a tremendous increase in the life of a die provides many advantages and improvements over the art. Thus with the dies of this invention more powder may be produced within a given period of time since the need of changing dies is reduced eleven times, further the ballistics of the powder produced is more uniform since the diameter of the powder grains are held more constant, and still further there is an added degree of safety in operation since each change of dies eliminated prevents possible accidents due to the friction of removing the dies from the die holders.

I do not limit my invention to any particular kind of a dense colloided smokeless powder, but I may use my invention in the manufacture of smokeless powder prepared by the use of fibrous nitrocellulose which, while not as severe on the die as smokeless powder prepared by the use of reworked smokeless powder, naturally causes a considerable wear on the dies. I may also use my invention in the preparation of any desired shape or form of strand of dense colloided powder. These strands of colloided powder may be solid or may have a single perforation as in the case of small arms powder, or may be multi-perforated as in the case of cannon powder. I may further use my invention in the preparation of so-called pyro-powders which contain no nitroglycerin or I may use my invention in the preparation of double base smokeless powders which contain nitroglycerin.

It will be understood that the details and examples given hereinbefore are illustrative only, and in no way limiting on my invention as broadly described hereinbefore and in the appended claims.

What I claim and desire to protect by Letters Patent is:

1. In a method of preparation of dense colloided smokeless powder, the step consisting of pressing a hard and tough nitrocellulose colloid through a forming die comprising approximately 85 to 86% iron, 13 to 14% chromium, .2 to .4% carbon, and .3 to .5% manganese.

2. In a method of preparation of dense colloided smokeless powder, the step consisting of pressing a hard and tough nitrocellulose colloid through a forming die comprising approximately 85 to 86% iron, 13 to 14% chromium, .2 to .4% carbon, and .3 to .5% manganese, said die being constructed to produce a tubular powder strand.

3. In a method of preparation of dense colloided smokeless powder, the step consisting of pressing a hard and tough nitrocellulose colloid through a forming die comprising approximately 85 to 86% iron, 13 to 14% chromium, .2 to .4% carbon, and .3 to .5% manganese, said die being constructed to produce a multi-tubular powder strand.

4. In a method of preparation of dense colloided double base smokeless powder, the step consisting of pressing a hard and tough double base nitrocellulose colloid through a forming die comprising approximately 85 to 86% iron, 13 to 14% chromium, .2 to .4% carbon, and .3 to .5% manganese.

5. A single hole die for smokeless powder presses, said die comprising 84 to 86% iron, 13 to 14% chromium, .2 to .4% carbon, and .3 to .5% manganese, and constructed to produce multi-perforated strands of pressed material.

6. A single hole die for smokeless powder presses, said die comprising 84 to 86% iron, 13 to 14% chromium, .2 to .4% carbon, and .3 to .5% manganese, and constructed to produce strands of smokeless powder.

7. A single hole die for smokeless powder presses, said die comprising 84 to 86% iron, 13 to 14% chromium, .2 to .4% carbon and .3 to .5% manganese, and constructed to produce hollow strands of smokeless powder.

HARRY C. SWENEY.