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SHOT SHELL WAD AND METHOD OF MAKING

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This invention relates to a process of making expansible shot shell wads and to the resulting shot shell wad.

Heretofore, in the manufacturing of shot shells, hair or felt wads have been principally used for the over-powder or "A" wad of the shell. Good felt, made of long animal hair or wool is very satisfactory, but is expensive. As a result, animal hair of lesser quality, such as the hair resulting from the dehairing of hides has been used for making "felt," but such lower quality felt is porous, highly variable in quality, easily shattered and generally unsatisfactory for making shotgun shell over-powder "A" wads. Yet such wads, because of low cost and absence of satisfactory substitutes, have been used. Various attempts have been made to provide substitute materials for replacing the low quality hair felt wads, but the substitute materials including cork have not proved satisfactory because of cost factors, poor performance and other reasons. A need has therefore existed for a better shot shell over-powder wad which will eliminate the defective characteristics of the present wads, such as broken wads, porosity and other disadvantages of the low quality hair felt wad now presently used.

It is therefore an object of this invention to provide an improved shot shell over-powder wad;

It is a further object of this invention to provide a new and improved shot shell wad which is economical in construction and provides an efficient gas seal between the powder gases and the shot; and does not disintegrate on firing;

It is a further object of this invention to provide a new and improved shot shell wad which will withstand storage satisfactorily at high temperatures;

It is still a further object of this invention to provide an improved expansible wad which will expand radially to affect sealing contact with the barrel of the gun upon firing;

An additional object of this invention is to provide a new and useful expansible shot shell wad of a resilient composition which will expand laterally upon compression;

Still another object of this invention is to provide an expansible shot wad which will aid materially in producing a superior symmetrical shot pattern;

A further object of this invention is to provide an improved material for shot shell wads which is more economical to produce and which has the characteristic of being easy to handle in the wad producing process;

A further object of this invention is to provide processes of producing improved shotgun shell wads;

Other and further objects of this invention are those inherent and apparent in the apparatus as described, and claimed.

In carrying out the instant invention, there is made use of a filler comprising flaked and screened bark of the Douglas fir tree. The bark of the Douglas fir tree is flaked and screened to give a material which has an appearance somewhat similar to that of ground-up cork but which is about as coarse as ordinary sawdust. To the flaked bark, which may be purchased as a standard commercial product under the trademark "Sylvacon," is added a rubber latex

which is free from free sulphur or sulphur compound. An aqueous emulsion of co-polymers of butadiene and acrylonitrile is very satisfactory. The latex and ground bark are then mixed thoroughly. The mixture of the flake bark and latex is then allowed to dry. In this dried stage the bark-latex mixture appears and handles like the original bark. It is easily stored, poured, screened, filled and weighed, and can be bulk stored without fire hazard.

It has been found that the synthetic latex, which may be obtained commercially under the trademark "Hycar" serves well as a binder with the flake bark inasmuch as it complies with the requirement that free sulphur be absent, and forms a superior product which will not remain sticky after drying. It was found, upon extensive experimentation, that wads made of this mixture possess great resiliency, and had a unique and important property and ability to expand laterally to a much greater extent than any other wad now in use as well as to compress to a lesser thickness. For example, a wad made according to the prescribed process as placed in a hydraulic press between a pair of steel plates and a pressure of 100 pounds per square inch was placed upon the plates. Upon being subject to this pressure, the wad expanded laterally until its diameter had increased approximately 2½ times and until it was compressed from about a height of 5/16 of an inch to a height of about 1/16 of an inch.

A similar test was given to a ¼ inch hair felt wad of usual commercial quality used in shotgun shells, but with a pressure greatly exceeding 100 pounds per square inch used to test the wad of the present invention, i. e., 450 pounds per square inch, it was found that such felt wad expanded laterally very little, if at all, but compressed to about ½ of its original thickness.

This characteristic of ready and appreciable lateral expansion is an important factor inasmuch as it increases the sealing of the wad against the shotgun barrel and as a result the powder gases do not so readily escape. Consequently, greater efficiency and hitting power is imparted to the shot. The proper sealing between the periphery of the wad and the interior of the barrel so as to seal the gases from the shot is also important since it prevents "balled" shot, and minimizes leading of the gun barrel and consequently provides for a good shot pattern.

In making the shot wad of the instant invention, an aqueous emulsion of the sulphur free latex binder is intimately mixed with the flaked bark filler until the particles of bark are uniformly coated with the latex. Then the material is spread out on a flat surface and dried either at room temperature or by forced air. After drying the coated bark particles are then broken into individual particles (which can be accomplished very easily). The dried coated flaked bark is then placed in molds and pressure applied to compress the material to the desired wad thickness. The wads are then waxed by a quick dip in melted paraffin.

The flaked bark filler may contain flakes ranging from 4 to 100 mesh size. However, I have found that a blend of flake sizes of which 75% will be retained on a 28 mesh screen and 25% will pass therethrough, and of which 25% will be retained on a 65 mesh screen to be advantageous for the production of wads according to the instant invention.

The rubber latex, binder emulsion should preferably contain a small amount of fatty acid soap such as sodium oleate. Similar emulsifying agents may be used. This emulsion is a stable suspension of spherical particles of the butadiene-acrylonitrile type rubber. The particle size of the suspended particles is approximately .06 micron in diameter, although this may be varied without departing from the spirit and scope of this invention. The latex binder is of a type which sets up by pressure instead of by cooling.

The mixture of binder and filler may be air-dried without agitation at room temperatures (70° to 80° F.) over a period of two to six hours or it may be dried in a rotary drier with a blast of air heated to 100° F. Temperatures in excess of 100° F. cause the mixture to lose "tack."

In the preferred process, 24 oz. of a blend of flake sizes of which 75% will be retained on a 28 mesh screen and 25% will pass therethrough and of which 25% will be retained on a 65 mesh screen, and 19 oz. by weight of the liquid latex binder containing approximately 40% solids (or the equivalent of greater or lesser concentration) are mixed in a mechanical mixer until the flake filler particles are uniformly coated with the latex binder. By "equivalent" amount of latex binder is meant one having an equal quantity of solids but diluted to a greater or lesser degree. Thus, twice as much binder having a solids content of 20% would be required as compared with one having 40% solid content. Although a mixture of 58% to 72% by weight of the flaked bark filler may be combined with 42% to 28% by weight of (40% solids) latex binder or its equivalent, I prefer to use a mixture of approximately 65% of flaked bark filler and 35% latex binder. The mixture is then spread out on a flat surface and allowed to stand at room temperature (70° to 80° F.) over a period of two to six hours, until all of the water has evaporated. Forced draft drying (with temperatures up to 100° F.) may be used. The flaked bark latex binder mixture is then broken up into individual particles and is screened.

The wads may be molded as follows: A charging plate of metal, having holes of the diameter of the wads desired to be produced, bored through it and a thickness of approximately 3 to approximately 4 times the thickness of the finished wad is laid out flat on a supporting surface and the dried mixture of flaked bark and latex rubber, prepared as aforesaid, is sifted onto the plate until the holes are filled. The plate is then struck off level so as to leave the holes uniformly level full of the mixture. After doing this, another (punch support) plate having punches set in it so as to extend down and register with the hole of the charge plate is set on top of the charge plate with the punches reaching down into registry with the filled holes to the charge plate. Guide pins are used for maintaining registry of the two plates and the whole set-up may be powered and operated by a press. The punches, punch support plate, should be of a diameter so as to have a neat sliding fit with the holes of the charge plate. Pressure is then applied so as (by the action of downwardly moving punches) to compress the mixture in the holes of the charge plate.

Pressures of 500 to 2000 lbs. per square inch on the filled material under compression in the holes of the charge plate, are used, the variation in pressure being roughly inversely proportional to the duration of compression. I prefer a pressure of about 1000 lbs. per square inch, and a setting time of about .2 second. Between the range of 500 to 2000 lbs. per square inch, the time of compression will vary from .5 second at the lower pressure to .05 second at the higher pressure. Heat is not required, the molding being accomplished at room temperature. After compression, the supporting plate under the charge plate is removed and by then pressing further down on the punches the wads are pushed out of the (bottom side of the) charging plate.

The finished wads are of short cylindrical shape and are made so as to have a (relaxed) diameter slightly in excess of the bore of the shotgun (and hence also, slightly in excess of the inner diameter of the shotgun shell paper tube core) with which the wad is to be used. A usual finished axial length of ¼" is suitable for most wads (several being used in multiple) but greater or lesser axial lengths of the finished wad may be used.

Greater axial lengths are obtained simply by using a charging plate of greater thickness, which therefore provides holes therethrough of greater depth for filling. The pressure applied to the wad and thickness (axial length of wad) should be adjusted so as to provide a final density of the wad in the range of 12 to 15 grams per cubic inch of wad material.

After the wads are thus formed, they are waxed by immersing for a few seconds in melted paraffin. The paraffin wax coats the surface of the wad but does appreciably penetrate the interior of the wad. The paraffin wax content of an average finished wad is about 14% and the wax penetrates about 1/14 inch into the surfaces of the wad.

As many widely differing embodiments of this invention may be made without departing from the spirit and scope of this invention, it is to be understood that I do not limit myself to the specific embodiments disclosed herein.

What I claim is:

1. A process of making shot shell wads comprising mixing a filler consisting essentially of flaked bark of the Douglas fir tree with a binder consisting essentially of an aqueous dispersion of a sulphur free rubber latex until the particles of bark are uniformly coated with said latex, drying the latex coated bark, separating the latex coated bark into particles, placing a charge of particles into a mold and compressing said particles to form a wad.

2. The process according to claim 1 further characterized in that the latex binder consists essentially of an emulsion of butadiene-acrylonitrile copolymer.

3. The process according to claim 1 further characterized in that said bark flakes are from 4 to 100 mesh size and 75% thereof will be retained on a 28 mesh screen.

4. The process according to claim 1 further characterized in that the mixture comprises from 58 to 72% by weight of filler and 42 to 28% of binder.

5. The process according to claim 1 further characterized in that the particles are compressed under a pressure of 500 to 2,000 pounds per square inch.

6. The process according to claim 1 further characterized in that the molded wad is waxed by dipping into a bath of molten paraffin.

7. A shot shell wad consisting essentially of a compressed mixture of flaked Douglas fir tree bark particles individually and uniformly coated with a sulphur free rubber latex binder.

8. A shot shell wad according to claim 7 further characterized in that the latex binder consists essentially of butadiene-acrylonitrile copolymer.

9. A shot shell wad according to claim 7 further characterized in that said bark flakes are from 4 to 100 mesh size and 75% thereof will be retained on a 28 mesh screen.

10. A shot shell wad according to claim 7 further characterized in that the wad mixture comprises from 58 to 72% by weight of filler and 42 to 28% of binder.

11. A shot shell wad according to claim 7 further characterized by a wax coating over the exterior thereof.

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