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## PROCESS FOR MANUFACTURING SHOTGUN SHELLS.

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This invention relates to the process of preparing paper tubes for use in the manufacture of shot gun shells and has for its object the provision of a process by which shells of more uniform characteristics, more attractive appearance, superior water resisting properties, greater resistance to cut-off, and generally improved characteristics shall be produced.

The invention is exemplified in the process and combination of steps thereof described in the following specification, and it is more particularly pointed out in the appended claims.

In the process of manufacturing shot gun shells as heretofore practiced, tubes have been formed by rolling the tubes from paper sheets, the tubes thus formed being sized to a suitable diameter by passing through dies and thereafter soaked in melted paraffine and cut into proper lengths for shells. Shot gun shells thus waterproofed were subject to great variation due to various proportions of wax content. Variation in density of paper, tightness of rolling, and differences in pasting all affected the ease with which the melted wax entered the tubes and consequently different batches of tubes received various percentages of wax and the completeness of impregnation varied in different tubes for particular portions thereof. It has been found that the waterproofing properties of the paraffine can be greatly increased if supplemented by a thin film of a proper drying oil or lubricating and drying mixture applied to the outer surface of the tube prior to impregnation with the wax, provided that a suitable process is employed to thoroughly impregnate the tube with the paraffine after the preliminary surface coating. It has also been discovered that if the proper material is used the oil for coating the outer surface of the tube may also be employed to serve the additional function of lubricating the tube for sizing by passing through the sizing dies.

I have found that a suitable material for lubricating the tubes for sizing and for forming the coating for the surface of the tubes is soya bean oil, especially when mixed with other ingredients to facilitate drying. I have found by mixing with the soya bean oil a small proportion of a mineral drier, such as lead oleate, for instance, or a suitable amount of an insoluble metallic soap, such as aluminum stearate, or both, a very efficient material is provided for lubricating the shells and forming the desired coating on the outer surface, when permitted to dry. For instance, I can use with success for the purpose described the following formula: 88% soya bean oil, 10% aluminum stearate, 2% lead oleate.

I am not, however, in successfully applying my invention, strictly limited, to the above percentages, but may vary them from time to time to suit variations in the quality of the oil used or other conditions. Nor am I strictly limited to lead oleate as a mineral drier or to aluminum stearate as an insoluble metallic soap, but cite each merely as suitable individual substances out of a group of many more or less suitable materials. Instead of lead oleate, I may use lead linoleate or cobalt acetate or zinc oleate, or one of many other driers suitable to my purpose. Instead of aluminum stearate I may use aluminum palmitate or copper oleate or zinc stearate or one of many other insoluble metallic soaps suitable to my purpose. The addition of a drier is advantageous as soya bean oil is of itself rather slow in drying; and insoluble soap is added for the purpose of increasing the waterproofing qualities of the oil. These ingredients are incorporated together by blowing air through the mixture at a temperature of from 400° to 450° Fahrenheit.

I have also found that pure Perilla oil is a suitable material for lubricating and coating the outer surface of the tube. The Perilla oil possesses such waterproofing qualities and it dries when spread in a film within such time that most grades are satisfactory for use in the raw state as purchased on the market. However, with some grades it may be desirable to add one or both of the other ingredients used in connection with the soya bean oil. The lubricating oil is applied to the tubes shortly or immediately before the ironing or sizing process, each tube being coated with a film of the lubricant. The tubes are then run through the sizing dies. After the sizing, each tube has on its external surface a thin film of the liquid waterproofing lubricant. The oils mentioned above are drying or semi-drying oils and are non-polymerizable and will not solidify when subjected to the ironing or sizing process. Nor do they solidify when

subjected to a high temperature as hereinbefore described, or in any other operation or stage of my process, except when spread on the tubes in a thin film exposed to the air, which slowly dries or hardens by absorption of oxygen from the air in the manner of a paint or varnish. The film of oil is allowed to remain undisturbed on the tubes for about thirty-six hours at room temperature, during which interval it partially penetrates the extreme outer skin or layer of the tube and dries like a varnish, leaving a smooth, attractive outer finish and a surface waterproofing film.

The application of the materials mentioned above to the surface of the tubes and the distribution of these materials by the dies during the sizing process, imparts to the tubes a high polish which is of exceptionally attractive appearance at the same time that the waterproofing film is applied. Where this preliminary coating is applied to the tubes, however, it is found impractical, at atmospheric pressure, to properly impregnate the paper of the tubes to complete the waterproofing process, for the reason that the coating material seals the outer surface of the tubes and partially saturates the paper, especially near the outer surface, so that paraffine wax or other waterproofing ingredients will not enter uniformly into the paper, except when subjected to a vacuum treatment, which will now be described.

After the coating material has dried the tubes are placed in a closed tank and the air is exhausted from within the tank and also from the pores of the paper, a high degree of vacuum being employed. While the vacuum is still maintained in the tank melted paraffine is drawn into the tank to completely cover the tubes. The paraffine is admitted under vacuum so that it may have opportunity to enter the pores of the tubes while the air is exhausted therefrom. While the tubes are still submerged in the paraffine the vacuum is released and the contents of the tank may or may not be subjected to pressure above atmospheric. This process impregnates the shells in a minimum of time and to a very high degree of uniformity not ootainable by the old process of subjecting the tubes to melted paraffine at atmospheric pressure and without the preliminary removal of air from the pores of the paper.

Combining the outer coating treatment and the vacuum wax treatment produces results in the waterproofing properties of the shells which greatly exceeds the aggregate of the effects of the two treatments separately. This may be easily demonstrated by subjecting the shells to a water immersion test, that is, by immersing the shells in water and noting the length of time required for them to swell to fit a standard gauge provided for the purpose. The highest degree of waterproofing obtained by treating shells with the paraffine process without providing the waterproofing outer coating is one and one-half hours for the particular gauge used in the tests employed. Where the shells are coated with a waterproofing film and the paraffine treatment omitted the shells swell to the size determined by the gauge in about fifteen minutes. When the shells are subjected to combined treatment of surface coating and vacuum impregnation the average time required to cause the shells to swell to fit the gauge is three hours and some shells will withstand the test for a period of four and one-half hours.

Another great advantage obtained by the treatment of the shells as outlined above is the elimination of what is termed "cut-off", that is the breaking or cutting of the shells at the end of the metal head. This effect which heretofore caused a great deal of trouble is produced by the heated gases which result when the shot shell is fired, the gases entering the pores of the paper and so weakening the tube that the pressure causes the paper to be cut off at the edge of the metallic head. Where the tubes are treated according to the present invention the paper is so thoroughly impregnated that the gases are excluded from entering the paper and cut-off is entirely eliminated.

Another advantage obtained by the treatment described above is improvement in the appearance of the finished shells. When the shells are first given an outer waterproofing coating using materials of the nature of those referred to and afterwards submitted to the vacuum treatment to impregnate the paper beneath the coating, it is found that a peculiarly attractive finish is produced which resembles somewhat certain wood graining. This is especially true when a dark red color is used. It is found that after the tubes have been given the outer coating and submitted to the vacuum paraffine treatment the surfaces of the tubes have an appearance resembling highly polished mahogany so that the cartridges have an exceptionally distinctive and attractive appearance.

While I refer in the foregoing specification and in the claims to "drying" oils, it will be understood that I use the term to cover, in addition to strictly "drying" oils, such suitable oils as are sometimes classified as "semi-drying". There is no sharp line of demarkation between strict "drying" and "semi-drying" oils, and where the oil used dries too slowly for convenience, a suitable drier may be employed as described, for example, in connection with the soya bean oil. It will be understood that the illustrations of my invention as given above are presented by way of example and that I do not wish to limit my invention to the details described, ex-

cept as particularly pointed out in the following claims.

I claim:—

1. The process of treating tubes for shot gun shells comprising the steps of applying a coating of lubricating drying oil to the outer surface of the tubes, passing the tubes through a sizing die, and permitting the oil to dry to form a waterproofing coating on the outer surface of said tubes.

2. The process of treating tubes for shot gun shells comprising the steps of applying a coating of lubricating drying oil to the outer surface of the tubes, passing the tubes through a sizing die, exposing the tubes to atmosphere for a period of time to permit the coating to dry and harden upon the surface of the tubes, and thereafter subjecting the tubes to a liquid waterproofing material in a vacuum chamber.

3. The process of treating tubes for shot gun shells comprising the steps of applying a coating of a drying lubricating material to the outer surface of the tubes, passing the tubes through a sizing die, exposing the tubes to atmosphere for a period of time to permit the coating to penetrate the material of the tubes and to dry and harden therein and on the surface thereof, subjecting the tubes to a vacuum to extract air from the pores thereof, and submerging the tubes in melted wax while still subjected to vacuum to cause the wax to thoroughly impregnate the material of the tubes.

4. The process of treating paper tubes for shot gun shells comprising the steps of applying a coating of lubricating drying oil to the outer surface of the tubes, passing the tubes through a sizing die, exposing the tubes to atmosphere for a period of time to permit the coating to dry and harden, subjecting the coated tubes to a vacuum to extract air from the pores of the tubular material beneath the coated surface, immersing the tubes in melted paraffine while still subjected to vacuum, and subjecting the tubes to pressure above atmospheric while immersed in the melted paraffine.

5. The process of treating paper tubes for shot gun shells comprising the steps of coating the outer surface of the tubes with a lubricating oil mixed with a drying agent, passing the coated tubes through a sizing die, permitting the oil to dry on the outer surface of the tubes, subjecting the tubes to a vacuum, and applying a waterproofing agent in liquid form to said tubes while subjected to vacuum.

6. The process of treating paper tubes for shot gun shells comprising the steps of applying a lubricating oil mixed with a drying agent and an insoluble metallic soap, to the outer surface of the tubes, passing the tubes through a sizing die, exposing the tubes to atmosphere to permit the coating to dry thereon, and thereafter impregnating the tubes with paraffine in a vacuum chamber.

7. The process of treating paper tubes for shot gun shells comprising the steps of applying soya bean oil to the surface of the tubes and permitting the oil to dry while exposed to atmosphere.

8. The process of treating paper tubes for shot gun shells comprising the steps of coating the outer surface of the tubes with a mixture containing soya bean oil and a drier, and permitting the mixture to dry while exposed to atmosphere.

9. The process of treating paper tubes for shot gun shells comprising the steps of coating the outer surface of the tubes with a mixture containing soya bean oil, a drying agent, and an insoluble soap, and permitting the mixture to dry while exposed to atmosphere.

10. The process of treating paper tubes for shot gun shells comprising the steps of coating the outer surface of the tubes with a waterproofing and lubricating material containing soya bean oil, passing the tubes through a sizing die to reduce the tubes to unform size and to distribute evenly the oil on the surface of the tubes, and thereafter permitting the oil to dry while exposed to the atmosphere.

11. The process of treating paper tubes for shot gun shells comprising the steps of applying to the tubes a coating of lubricating and waterproofing material the principal ingredient of which is soya bean oil, passing the coated tubes through a sizing die while the tubes are wet with the mixture, permitting the mixture to dry while exposed to atmosphere, subjecting the tubes to vacuum to extract air from the material of the tubes beneath the surface coating, and thereafter flooding the tubes with melted paraffin while still subjected to vacuum.

12. The process of treating paper tubes for shot gun shells comprising the steps of coating the outer surface of the tubes with a mixture of soya bean oil and a drying agent, passing the tubes through a sizing die while wet with the mixture, permitting the mixture to dry while exposed to atmosphere for a period of approximately thirty-six hours, subjecting the tubes to vacuum to extract air from the pores thereof, immersing the tubes in melted paraffin while still subjected to vacuum, and thereafter applying pressure above atmosphere to the tubes while still submerged in the paraffin.

In testimony whereof I have signed my name to this specification on this 17th day of March, A. D. 1926.

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