PATENT SPECIFICATION

Application Date: Sept. 19, 1935. No. 25957/35. **457,294**

Complete Specification Left: Sept. 26, 1935.

Complete Specification Accepted: Nov. 25, 1936.

PROVISIONAL SPECIFICATION

Improvements in or relating to the Manufacture of Cartridge Cases

I, HORACE AINLEY ROBERTS, of 9, Lindley Moor, Huddersfield, in the County of York, a British Subject, do hereby declare the nature of this invention to be as follows:—

This invention relates to the manufacture of shot gun cartridge cases and in particular to cartridge cases which are moulded from thermo plastic materials.

It has been proposed to manufacture cartridge cases from mouldable material such as celluloid, cellulose acetate compositions, synthetic resin, casein, and the like, but as far as I am aware commercially successful cartridge cases containing such compositions have not yet appeared on the market. While compositions of this kind can be satisfactorily moulded into articles such as ash trays, drinking cups and the like, where these articles are not called upon to withstand any serious strains in normal use, cartridge cases moulded from plastic materials are, on the other hand, required to withstand very severe internal pressures up to about half a ton per square inch at the moment of firing. This necessitates sufficient elasticity in the tubular portion to allow it to stretch to the chamber walls of the gun and afterwards at least partially return to its original size. This latter property is necessary to ensure satisfactory ejection after firing. The tube must also be sufficiently flexible or pliable to allow it to be turned over in the usual way to hold the contents of the case firmly in position when this method of retention is used. Moreover, the head portion of the cartridge case which is moulded integrally with the tube must have sufficient elasticity and resilience to allow it to compress to the gun chamber walls under the pressure of the powder gases. On the other hand, the head must be sufficiently rigid to hold the ignition system firm against the striker blow so that the necessary sensitiveness can be obtained.

I have found that highly satisfactory cartridge cases can be manufactured from thermo plastic materials containing a binding medium such as cellulose acetate or other cellulose derivative or mixed esters and ethers of cellulose, or vinyl and acrylic acid derivatives, provided that a sufficient quantity of suitable plasticiser or plasticisers such as tri-ethyl-citrate, triacetin, ethyl phthalate, di-amyl tartrate, tri-phenyl phosphate, or tri-cresyl phosphate is incorporated in the mixture, together with a suitable filler or fillers such as ground cereal, french chalk, carbon black, or the like.

The essence of my invention resides in the correct proportioning of the plasticiser and the binding medium and I have found that the ratio of the plasticiser content to the amount of binding medium i.e. cellulose acetate or the like should be from 45 parts to 75 parts of plasticiser to 100 parts of binding medium. The amount of filler should preferably not exceed 75% of the binding medium. This ratio of plasticiser to binding medium is very important in the manufacture of shotgun cartridge cases and numerous experiments have shown that while it is possible to mould cartridge cases from plastic materials having proportions of plasticiser and binding medium outside the desired ratio, such cases are unreliable in use since they are either too brittle and consequently break in the gun, or they are too soft for practical purposes.

In one example of carrying my invention into effect I mould shotgun cartridge cases from a plastic material having the following composition:—Cellulose Acetate 100 parts, Tri-ethyl-citrates 68 parts and finely ground wheat flour 75 parts. The acetate is dispersed in a solvent such as acetone and other ingredients added and mixed, the solvent being evaporated and the residue cut up or granulated.

In a further example of a suitable composition the following components may be used:

Cellulose Acetate - - - 100 parts
Di-ethyl-phthalate - - 72 parts
Finely ground wheat flour 66 parts

In a still further example of a suitable

[*Price* 1/-]

composition the following components may be substituted.

Cellulose Acetate - - -	100 parts
Di-ethyl-phthalate - -	60 parts
Tri-Phenyl Phosphate -	12 parts
Finely ground wheat flour	65 parts

The cartridge case is moulded with the aid of pressure and heat, the procedure being very similar to that employed for products moulded from cellulose derivatives. The granulated moulding material is placed within a steam heated cylindrical mould, the lower part of which is shaped to form the rim of the cartridge case.

A concentric cylindrical plunger having a slight taper is introduced under hydraulic pressure into the mould and causes the material to flow into the required shape. In the lower part of the mould is formed a cavity which is adapted to accommodate the ignition primer.

The mould is preferably cooled after the steam heating has been turned off so that the case can be quickly removed from the mould. After trimming the edge of the case the primer consisting of a cap chamber and cap and anvil is inserted, the cap and anvil being assembled in the cap chamber and the combination being then pressed into the cavity previously referred to.

Where it is essential that the cartridge cases shall be completely water resisting, non-hydroscopic fillers such, for example, as french chalk, lamp black or carbon black may be used in place of or together with finely ground wheat flour, or other cereals.

As an example the following components may be used.

Cellulose Acetate - - -	100 parts
Di-Ethyl-Phthalate - -	60 parts
Tri-Phenyl-Phosphate -	12 parts
French Chalk - - - -	70 parts

It will be noticed that in this example both the filler and the plasticising agents are substantially water resisting and I have found that cartridge cases produced from this composition are for all practical purposes as water resisting as metal cartridge cases.

Where a substantially white or uncoloured filler is used such as a cereal filler or french chalk, various pigments may be used or incorporated in the composition to produce different coloured cartridge cases such as are required by the trade.

Dated this 18th day of September, 1935.

APPLEYARD & CROSSLEY,
41, Commercial Street, Halifax.
Agents for the Applicant.

COMPLETE SPECIFICATION

Improvements in or relating to the Manufacture of Cartridge Cases

I, HORACE AINLEY ROBERTS, of 9, Lindley Moor, Huddersfield, in the County of York, a British Subject, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to the manufacture of shot gun cartridge cases and in particular to cartridge cases which are moulded from thermo plastic material.

It has been proposed to manufacture cartridge cases from mouldable material such as celluloid, cellulose acetate compositions, synthetic resin, casein, and the like, but as far as I am aware commercially successful cartridge cases containing such compositions have not yet appeared on the market. While compositions of this kind can be satisfactorily moulded into articles such as trays, drinking cups and the like, where these articles are not called upon to withstand any serious strains in normal use, cartridge cases moulded from plastic materials are, on the other hand, required to withstand very severe internal pressures up to about half a ton per square inch at the moment of firing. This necessitates sufficient elasticity in the tubular portion to allow it to stretch to the chamber walls of the gun and afterwards at least partially return to its original size. This latter property is necessary to ensure satisfactory ejection after firing. The tube must also be sufficiently flexible or pliable to allow it to be turned over in the usual way to hold the contents of the case firmly in position when this method of retention is used. Moreover, the head portion of the cartridge case which is moulded integrally with the tube must have sufficient elasticity and resilience to allow it to compress to the gun chamber walls under the pressure of the powder gases. On the other hand, the head must be sufficiently rigid to hold the ignition system firm against the striker blow so that the necessary sensitiveness can be obtained.

I have found that highly satisfactory cartridge cases can be manufactured from thermo plastic materials containing a

binding medium such as cellulose acetate or other cellulose derivative or mixed esters and ethers of cellulose, or vinyl and acrylic acid derivatives, provided that a sufficient quantity of suitable plasticiser or plasticisers such as tri-ethyl-citrate, triacetin, ethyl phthalate, di-amyl tartrate, tri-phenyl phosphate, or tri-cresyl phosphate is incorporated in the mixture, together with a suitable filler or fillers such as ground cereal, french chalk, carbon black or the like.

The essence of my invention resides in the correct proportioning of the plasticiser and the binding medium and I have found that the ratio of the plasticiser content to the amount of binding medium, i.e. cellulose acetate or the like should be from 45 parts to 75 parts of plasticiser to 100 parts of binding medium, depending upon the elasticity, flexibility, resilience, toughness and water resisting properties of each or any of the plasticisers used. The amount of filler should preferably not exceed 75% of the binding medium. This ratio of plasticiser, to binding medium is very important in the manufacture of shotgun cartridge cases and numerous experiments have shown that while it is possible to mould cartridge cases from plastic materials having proportions of plasticiser and binding medium outside the desired ratio, such cases are unreliable in use since they are either too brittle and consequently break in the gun, or they are too soft for practical purposes.

In one example of carrying my invention into effect I mould shotgun cartridge cases from a plastic material having the following composition:—Cellulose Acetate 100 parts, Tri-ethyl-citrate 68 parts and finely ground wheat flour 75 parts. The acetate is dispersed in a solvent such as acetone and other ingredients added and mixed, the solvent being evaporated and the residue cut up or granulated.

In a further example of a suitable composition the following components may be used.

	parts
Cellulose Acetate - -	100
Di-ethyl-phthalate -	72
Finely ground wheat flour - - -	66

In a still further example of a suitable composition the following components may be substituted.

	parts
Cellulose Acetate - -	100
Di-ethyl-phthalate -	60
Tri-Phenyl Phosphate -	12
Finely ground wheat flour - - -	65

The cartridge case is moulded with the aid of pressure and heat, the procedure being very similar to that employed for products moulded from cellulose derivatives. The granulated moulding material is placed within a steam heated cylindrical mould, the lower part of which is shaped to form the rim of the cartridge case.

A concentric cylindrical plunger having a slight taper is introduced under hydraulic pressure into the mould and causes the material to flow into the required shape. The lower part of the mould is shaped to form a cavity which is adapted to accommodate the ignition primer.

The mould is preferably cooled after the steam heating has been turned off so that the case can be quickly removed from the mould. After trimming the edge of the case the primer consisting of a cap chamber, cap and anvil is inserted, the cap and anvil being assembled in the cap chamber and the combination being then pressed into the cavity previously referred to.

Where it is essential that the cartridge cases shall be completely water resisting, non-hydroscopic fillers such, for example, as french chalk, lamp black or carbon black may be used in place of or together with finely ground wheat flour, or other cereals.

As an example the following components may be used.

	parts
Cellulose Acetate - -	100
Di-Ethyl-Phthalate -	60
Tri-Phenyl-Phosphate -	12
French Chalk - -	70

It will be noticed that in this example both the filler and the plasticising agents are substantially water resisting and I have found that cartridge cases produced from this composition are for all practical purposes as water resisting as metal cartridge cases.

Where a substantially white or uncoloured filler is used, such a cereal filler or french chalk, various pigments may be used or incorporated in the composition to produce different coloured cartridge cases such as are required by the trade.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. The manufacture of shotgun cartridge cases moulded from thermo plastic materials in which the ratio of the plasticiser content to the amount of binding medium varies from 45 parts to 75 parts

binding medium such as cellulose acetate or other cellulose derivative or mixed esters and ethers of cellulose, or vinyl and acrylic acid derivatives, provided that a sufficient quantity of suitable plasticiser or plasticisers such as tri-ethyl-citrate, triacetin, ethyl phthalate, di-amyl tartrate, tri-phenyl phosphate, or tri-cresyl phosphate is incorporated in the mixture, together with a suitable filler or fillers such as ground cereal, french chalk, carbon black or the like.

The essence of my invention resides in the correct proportioning of the plasticiser and the binding medium and I have found that the ratio of the plasticiser content to the amount of binding medium, i.e. cellulose acetate or the like should be from 45 parts to 75 parts of plasticiser to 100 parts of binding medium, depending upon the elasticity, flexibility, resilience, toughness and water resisting properties of each or any of the plasticisers used. The amount of filler should preferably not exceed 75% of the binding medium. This ratio of plasticiser, to binding medium is very important in the manufacture of shotgun cartridge cases and numerous experiments have shown that while it is possible to mould cartridge cases from plastic materials having proportions of plasticiser and binding medium outside the desired ratio, such cases are unreliable in use since they are either too brittle and consequently break in the gun, or they are too soft for practical purposes.

In one example of carrying my invention into effect I mould shotgun cartridge cases from a plastic material having the following composition:—Cellulose Acetate 100 parts, Tri-ethyl-citrate 68 parts and finely ground wheat flour 75 parts. The acetate is dispersed in a solvent such as acetone and other ingredients added and mixed, the solvent being evaporated and the residue cut up or granulated.

In a further example of a suitable composition the following components may be used.

	parts
Cellulose Acetate - -	100
Di-ethyl-phthalate -	72
Finely ground wheat flour - - -	66

In a still further example of a suitable composition the following components may be substituted.

	parts
Cellulose Acetate - -	100
Di-ethyl-phthalate -	60
Tri-Phenyl Phosphate -	12
Finely ground wheat flour - - -	65

The cartridge case is moulded with the aid of pressure and heat, the procedure being very similar to that employed for products moulded from cellulose derivatives. The granulated moulding material is placed within a steam heated cylindrical mould, the lower part of which is shaped to form the rim of the cartridge case.

A concentric cylindrical plunger having a slight taper is introduced under hydraulic pressure into the mould and causes the material to flow into the required shape. The lower part of the mould is shaped to form a cavity which is adapted to accommodate the ignition primer.

The mould is preferably cooled after the steam heating has been turned off so that the case can be quickly removed from the mould. After trimming the edge of the case the primer consisting of a cap chamber, cap and anvil is inserted, the cap and anvil being assembled in the cap chamber and the combination being then pressed into the cavity previously referred to.

Where it is essential that the cartridge cases shall be completely water resisting, non-hydroscopic fillers such, for example, as french chalk, lamp black or carbon black may be used in place of or together with finely ground wheat flour, or other cereals.

As an example the following components may be used.

	parts
Cellulose Acetate - -	100
Di-Ethyl-Phthalate -	60
Tri-Phenyl-Phosphate -	12
French Chalk - -	70

It will be noticed that in this example both the filler and the plasticising agents are substantially water resisting and I have found that cartridge cases produced from this composition are for all practical purposes as water resisting as metal cartridge cases.

Where a substantially white or uncoloured filler is used, such a cereal filler or french chalk, various pigments may be used or incorporated in the composition to produce different coloured cartridge cases such as are required by the trade.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. The manufacture of shotgun cartridge cases moulded from thermo plastic materials in which the ratio of the plasticiser content to the amount of binding medium varies from 45 parts to 75 parts

of plasticiser to 100 parts of binding medium, the amount of filler preferably not exceeding 75% of the binding medium.

2. The manufacture of shotgun cartridge cases according to Claim 1 in which the binding medium consists of cellulose acetate, mixed esters and ethers of cellulose or other cellulose derivatives or vinyl and acrylic acid derivatives, and in which the plasticiser consists of one or more of the following:—tri-ethyl-citrate, triacetin, ethyl phthalate, di-amyl tartrate, tri-phenyl phosphate, or tri-cresyl phosphate.

3. The manufacture of shotgun cartridge cases according to Claim 1 in which the filler consists of finely ground cereal such as wheat flour and/or non-hygroscopic material such as french chalk, lamp black or carbon black.

4. The manufacture of shotgun cartridge cases according to Claim 1 in which both the filler and the plasticising agents are substantially water resisting.

5. The manufacture of cartridge cases according to any one of the preceding claims in which the cartridge case is moulded substantially as described and in which a cavity is formed in the base portion of the said cartridge case for the reception of the ignition primer which is frictionally held in position.

6. Method of manufacture of cartridge cases substantially as hereinbefore described.

7. Cartridge cases whenever made by the method claimed in any of the preceding claims.

Dated this 25th day of September, 1935.

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Agents for the Applicant.

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