

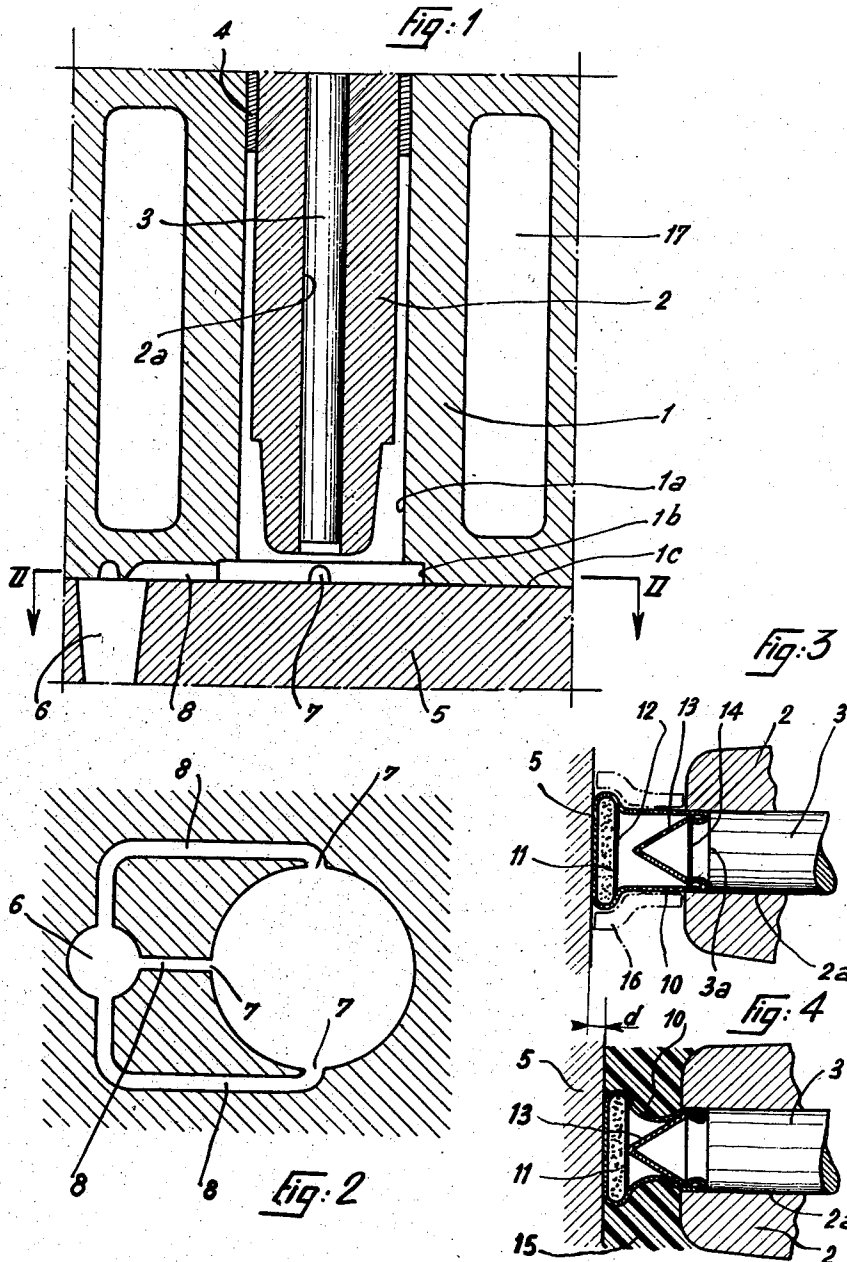
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METHOD FOR THE MANUFACTURE OF CARTRIDGE CASES FOR FIREARMS

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METHOD FOR THE MANUFACTURE OF CARTRIDGE CASES FOR FIREARMS

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2 Claims. (Cl. 86—10)

It has already been proposed a long time ago to construct cartridge cases for firearms wholly of plastic material. Up to the present time however, it would not appear that the problem of manufacture of these cases has been solved in a satisfactory manner. The cartridges made from these cases have given rise to a considerable number of mishaps. In general, these cases split when fired. In addition, the fixing of the detonator in the base of the case is especially awkward. In practice, on the one hand, a free insertion of the percussion cap or primer in the housing provided for it in the case does not provide a satisfactory method of fixing the primer and tends to interfere with the gas-tightness of the cartridge; on the other hand, the applicant has discovered as a result of his researches, that forcible insertion of the primer may be considered to be one of the causes of splitting of the case at the moment of firing.

The present invention has for its object to provide means for enabling cartridge cases to be produced which give complete satisfaction during firing. One of the special features of the invention consists in incorporating the primer in the case at the moment when the latter is moulded, and to carry out the moulding operation under conditions of temperature and pressure such that they do not lead to destruction of said primer.

A primer, which is essentially composed of a small tube with thin walls, and which is thus very easily put out of shape, and which contains for example fulminate of mercury, that is to say an essentially unstable substance which is sensitive to mechanical treatment as well as to increases in temperature, cannot in fact be compared to the metallic inserts which are commonly incorporated during moulding in certain articles of plastic material. The inclusion of a detonator of this kind in a case mould is fundamentally a dangerous operation and requires a considerable number of precautions in order that the moulding shall be satisfactorily carried out.

Now, the applicant has also found that the moulding conditions required so as to ensure the safety of the primer are also those which give the best mechanical strength to the body of the case. In addition, these moulding conditions represent a sufficient departure from the conditions usually laid down for the technique of moulding of plastic materials, for them to be considered as inherently constituting a method of manufacture, quite separate from the inclusion, during moulding, of the primer in the cartridge case. It is however to be understood that this incorporation gives the best results. In fact, a perfect bond is automatically ensured between the primer and the case, and all the drawbacks previously referred to are thus avoided. In addition, the primer-insertion stage in the manufacture of cartridges is eliminated, and this reduces the cost price of production.

Amongst the thermo-plastic materials which appear to be the most satisfactory for the production of cartridge cases, special mention should be made of the ethylcelluloses, for example that which is sold commercially under

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the name of Ethocel LT6, by the Dow Chemical Company. Other ethyl celluloses have also given satisfaction.

It is known that a cartridge case for firearms comprises a thick rear portion or base which is generally provided with a rim, in which base the primer is centrally mounted, and a front portion, the general shape of which is usually a cylinder with thin walls.

In theory, the moulding of an object of this kind does not offer any difficulty, and the design of the mould by which it is obtained is quite obvious. A mould of this kind will comprise an external portion in which is formed a chamber corresponding to the external shape of the cylindrical part of the case, including the rim, a core intended to form inside the case the charging space, and a mould bottom which shapes the form of the rear section of the base of the case and which is removable so as to permit of the extraction of the moulded case from the mould.

In accordance with a special feature of the invention, the channel or channels for injection of the plastic material into the said mould are located on a level with the rim of the case, that is to say they may be formed, either in the base of the mould or in the external part of the mould and in that face of it against which the base of the mould is applied. A number of injection conduits are preferably uniformly spaced around the periphery of the rim of the same case, this system having a number of advantages.

In the first place, during the moulding of the casing, the thicker portion of the base fills up completely first of all with plastic material, after which the material can advance axially as a whole over the entire periphery of the case in order to form the thin portion of this latter. There is thus obtained a very homogeneous thin portion which, in particular, has no "welded joint." As a matter of fact, in the absence of this first precaution, which is inherent in the design of the mould itself, the injected material forms a kind of layer wound about the central core, the two edges of the layer becoming welded together roughly along a generatrix of the casing. Such a case will inevitably split when fired, along this generatrix. In addition, the large number of injection conduits is favourable to moulding with a plastic material in a relatively viscous state, as will be more fully explained later.

In accordance with a further special feature of the invention concerning the method of moulding, the mould is strongly cooled, for example by circulation of water from the mains, so as to be kept at a temperature less than 25° C. In this way, the heating effect is reduced, in the first place, on the primer incorporated in the mould, and this minimises the risk of explosion of the latter and even the risk of detachment of the fulminate from the bottom of the primer. In addition, the use of a cold mould has favourable results as regards the strength of the moulded material. The solidification of this material is in fact carried out by contact with the cold walls of the mould in concentric layers, which is favourable to a good mechanical resistance of the casing to internal expansion stresses at the moment of firing. It is furthermore sufficient to tear the wall of a cartridge case obtained in accordance with the invention to establish the presence of this formation of concentric layers of the moulded material. This special feature enables immediate recognition of the cases which have been moulded by the method according to the present invention.

It should be noted that the use of a mould as cold as in the present case is not generally recommended for the moulding of plastic materials, and in particular of ethylcelluloses, for which temperatures of the mould of the order of 50° C. are normally laid down.

In accordance with a further special feature of the invention, the temperature of the plastic material at the

moment of moulding is less than 200° C. and is preferably comprised between 170° C. and 190° C. In addition, the injection speed is quite low.

In this way, the material being more viscous than in the case of the usual injection technique and the injection pressure being lower and applied more slowly, the hydraulic pressure transmitted to the primer is considerably reduced, and this avoids the risks of explosion of this latter: in addition, there is fully obtained in this way one of the desired results, namely the filling of the base portion first followed by the regular advance of the material into the thin portion of the casing and in the direction of the axis of the latter.

As in the previous case, it will be noted that the injection temperatures recommended by the specialists are, in particular in the case of ethyl-celluloses, greater than 200° C. and that, moreover, in order usually to obtain a satisfactory filling of the mould, a very intense and rapid injection is recommended, that is to say at a speed and pressure which are as high as possible. For the reasons already referred to (risks of welded joints), such a method of injection is not at all suitable for the moulding of a cartridge case.

The mould in accordance with the invention, which enables the application of the method of moulding, the special features of which have just been indicated, may comprise, in addition, a device for holding the detonator in the mould during the moulding operation, and a device enabling the moulded cartridge case to be ejected from the mould.

In one advantageous form of construction of this mould, the core comprises an axial conduit through which passes a sliding pin. To carry out its insertion in the mould, the open end of the primer may be introduced in the orifice of the conduit of the core which is turned towards the base. The primer, which is preferably freely inserted into this conduit, comes up against the extremity of the pin and, at the moment of closing of the mould, its extremity is slightly crushed against this pin. There is thus obtained a firm fixation of the primer in the moulding cavity and furthermore, any penetration of plastic material into the orifice of the primer is prevented. In addition, the said pin may be employed for the purpose of ejecting the finished cartridge case from the mould.

An additional ejector may preferably be provided at the extremity of the tubular part of the case. This ejector is constituted by a cylinder having a thickness equal to that of the tubular part of the case which closes the mould at the side opposite to the base.

The invention also includes cartridge cases of plastic material and loaded cartridges produced in accordance with the method of the invention or with the moulding arrangements specified which are especially suited to the carrying into effect of this method.

The description which follows below with regard to the attached drawings (which are given by way of example only, and not in any sense by way of limitation), will make it quite clear how the invention may be carried into effect.

Fig. 1 shows in cross-section through the axis of the cavity intended to form a cartridge case, a portion of a mould in accordance with the invention.

Fig. 2 is a cross-section taken along the line II—II of Fig. 1.

Fig. 3 shows an enlarged view of the axial cross-section of a primer at the moment at which it is placed in position inside the mould.

Fig. 4 is analogous to Fig. 3 and shows this primer deformed at the same time by the closing of the mould and by the moulding operation.

The mould, which is partially shown in Fig. 1, comprises an external part 1 in which is formed a bored portion 1a corresponding to the external shape of the case. This bore is widened at the base at 1b so as to form the rim of the case. In the bore 1a is engaged the

core 2 intended to form the chamber which receives the charge of the cartridge. The space comprised between the bore and the core, after filling with plastic material, will thus form the wall of the cartridge. This wall is thin at its upper part and thicker at its lower part or base. The mould comprises, in addition, inter-communicating cavities 17 for the circulation of a cooling fluid.

In order to facilitate drawing out of the moulded cartridge case, a slight draw-taper may be given to the mould, this taper giving the cartridge case a slightly conical form which does not adversely affect it in use. The core 2 is provided with an axial conduit 2a, in which is arranged to slide a pin 3 actuated by external means, not shown, but which are well known in the art of moulding of plastic materials.

In the space comprised between the wall of the bore 1a and that of the core, there may also slide a thin cylinder 4, the extremity of which forms the upper limit of the cavity of the mould and which, in addition, may serve as an ejector for the discharge of the moulded cartridge case in the downward direction in respect of Fig. 1.

Finally, the mould is closed by a bottom 5 intended to form the base of the cartridge case, in which base there is provided the main injection conduit 6, outwardly flared in the usual way.

From this injection conduit, the secondary conduits intended to lead the material into each of the moulding cavities are branched (the number of these cavities may have any particular value in the same mould), and these cavities are all similar to that shown in Fig. 1.

These secondary conduits may be provided in the form of grooves, either in the face 1c of the portion 1, against which is applied the base 5, or in the face of this base itself. Starting from the main conduit 6, they lead into the widened portion intended to form the rim at a certain number of points 7 distributed around the periphery of this rim.

As shown in Fig. 2, these secondary channels 8 may have a cross-section which increases in proportion with their length.

When a relatively viscous material is injected at reduced pressure, and thus at a low speed, into these injection conduits, this material collects first of all in the base of the case which it fills and then advances with a practically uniform movement to form the tubular thin portion of the case. As the mould is cold, there is an almost immediate solidification of the material in contact with the walls, thus forming a kind of skin, following which the material which is still viscous moves forward between the skins formed in contact with the walls until the casing is completely formed. The material in contact with the walls of the mould thus forms a foliated structure.

In addition, the thin cylindrical portion may practically be considered as being obtained by extrusion rather than by moulding, and this is again a favourable factor in connection with the strength of the walls. At the end of the moulding operation, a higher injection pressure may be applied to the material injected in order to complete the filling of the mould and to avoid occlusions.

In order to obtain a solidifying action in foliated layers, and the effect of extrusion in the thin part of the casing, an injection speed as low as possible is clearly favourable; if the speed is too low however, there is a risk of causing a premature total solidification in the thin part of the casing because of the low temperature of the mould. It is thus desirable to use injection pressures such that the material progresses axially in the thin part of the casing at a speed of the order of a few centimeters per second.

The injection pressures which enable this result to be obtained are definitely lower than the usual pressures, and this has a further advantage: the force required to keep the mould closed is appreciably smaller, which enables less powerful presses to be employed than with the usual technique. It may be roughly estimated that the closing force required is only half that which would be

necessary in the case of moulding of similar objects, following the usual practice.

When the moulding is completed, a thrust applied to the members 3 and 4, after the bottom of the mould has been opened, enables the moulded case or cases to be ejected towards the bottom of the figure.

The conjunction of these two members in order to obtain ejection of the moulded article avoids any deformation of the case when discharged from the mould, these cases being then, furthermore, already sufficiently rigid because of the solidifying action of the material in the cold mould.

The mould constructed in this way may thus enable the manufacture to be carried out of cases without primer, in which cases the housing of the detonator may be formed previously or alternatively, in which the cavity necessary for the housing for the detonator may be carried out after moulding by drilling. However, this drilling operation and the introduction of the primer into the base of the case, may give rise to stresses in the material which are likely to result in bursting.

In the mould just described, the primer is put in position before injection of the plastic material, in such manner that this primer is incorporated into the case itself from the moment of moulding.

A primer of a cartridge case is, as is known and also as shown in Fig. 3, generally constituted by a small tube 10 open at one end, generally of brass or thin copper, in the base of which is disposed a certain quantity of fulminate of mercury 11; this fulminate is retained by a light membrane 12, against which is applied the percussion anvil 13. This percussion anvil is generally constituted by a small strip of metal folded in the shape of a V, the arms of which are fixed to the internal wall of the tube 10 and the point is in contact with the membrane 12; in general, the extremity of the tube 10 is turned in, in order to retain a closure membrane 14 of thin paper.

In order to incorporate the primer in the mould, the end of the tube 10 is inserted in the opening of the conduit 2a of the core which is turned towards the base, the pin 3 being momentarily fixed by external means; the end of the tube 10 thus comes up against the face 3a of this pin. When the mould is closed, the base 5 of the mould is applied against the bottom of the tube 10 and crushes the extremity of this tube against the pin 3. There is thus obtained a close application of the end of this tube against the internal wall of the conduit 2a, which fixes the primer inside the moulding cavity and prevents any entry of the plastic material injected into this conduit and, in consequence, into the opening of the primer.

This particular feature is shown diagrammatically in Figs. 3 and 4 by the displacement *d* of the bottom 5 of the mould at the moment when the mould is closing. After this stage, as can be seen in Fig. 4, the plastic material 15 injected surrounds the body of the tube 10, and the pressure of this material caves the walls of this tube in slightly and finally fixes the primer in the base, or in other words, the bond between the primer and the base is not a simple matter of adhesion of the primer

to the plastic material, but there is produced, in fact, a real inseting of this primer in the plastic material.

The usual commercial types of primer may be employed and preferably those which have a tube of sufficient length to ensure the effect shown in Fig. 4. If need be, it is also possible, in order to still further reduce the risk of explosion of the detonator at the moment of injection of the plastic material, to coat a part of the periphery of this primer with a layer of protective heat-insulating material, this layer being indicated by the dotted lines 16 in Fig. 3 and being composed with advantage of a ring of plastic material adhering to the tube 10.

The cartridge cases manufactured in this manner may be used in the same way as the usual cases, that is to say they may be loaded and then closed. For this latter operation, it is an advantage to soften the extremity of the case by slightly heating it in order to facilitate the sealing-in operation. This latter operation may be carried out in different ways, depending on the nature of the charge (cartridges with small shot or ball).

It will, of course, be understood that modifications may be made to the method and the apparatus which have been described above, in particular by the substitution of equivalent technical means, without thereby departing from the spirit or from the scope of the present invention.

What I claim is:

1. A method of moulding a primed cartridge case in one single piece comprising a base and a substantially cylindrical thin portion, with plastic material, in a mould having a cavity, the shape of which corresponds to said case, said method comprising the steps of placing the primer of the cartridge in position in the mould of said case, maintaining the mould at a temperature lower than 25° C. and injecting the plastic material at a temperature less than 200° C. through a plurality of injection inlet orifices distributed around the part of said cavity corresponding to said base with an injection pressure providing, after filling of said base, a speed of progression of said plastic material of a few centimeters per second in the thin portion of said cavity along the axis thereof and towards the extremity of said thin portion.

2. A method according to claim 1 in which said plastic material is an ethyl-cellulose, the temperature of injection is comprised between 170 and 190° C. and the mould is kept at a temperature between 10 and 15° C.

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