THE JOINT EXAMINATION BOARD

PAPER P3

PREPARATION OF SPECIFICATIONS FOR UNITED KINGDOM

23rd April, 1996

10.00 a.m. - 2.00 p.m.

Please read the following instructions carefully. This is a ***FOUR HOUR*** Paper.

1. Write on one side of the paper only using ***BLACK*** ink. You must write your examination number and the designation of the Paper in the top right hand corner of the sheet. You must not state your name anywhere in the answer.

2. ***NO*** printed matter or other written material may be taken into the examination room.

3. Answers **MUST** be legible. If Examiners cannot read your work, they cannot award you marks for your answer.

List of documents supplied: Client's Memo
3 Sheets of Drawings
Extracts of FR-B-1 342 377 (3 sheets)

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Your Client writes:-

"As you know, we have been making and supplying cans to the food industry for filling for many years. Each week our fleet of lorries leaves our works bound for our customers carrying essentially air surrounded a number of cylindrical cans. The empty cans are open at one end, and are supplied to the cannery in cases of 40. At the cannery, the cans are removed from the cases and placed on a filling line. Looking at this operation, it is very apparent that it is costly and inefficient, since the lorries are being underutilized in terms of their carrying capacity, and the handling of the cans in stacking the filling line at the cannery is labour-intensive. In order to overcome this problem we have been looking at methods of shaping can blanks so that they can be nested or so that we can produce novel and different shapes.

We have been looking at this problem for some time now and have come across a very old French Patent No 1,342,377 (Continental Can Co.), Figures 1 to 9 of which show a method of shaping cans by explosion forming. As you can see from the Figures, a cylindrical can blank (16) is presented to a forming station comprising a two-part shaping mould (35), the open end of the can is closed by presenting the blank (16) into sealing engagement with a sealing ring (26) (see Fig. 1)of closure plate (24), and a combustible mixture is introduced to the inside of the can by means of inlet (30/31) which is then ignited by means of igniter (28/29). The resultant rapid increase in temperature and pressure results in the plastic deformation of the can material with the can assuming the internal shape of the mould surface.

This process suffers from two disadvantages, of which one is the problem of holding the mould closed during the combustion. No matter how massive we make the mould closing mechanism, when the combustion takes place the shock of the combustion momentarily urges the two halves of the mould apart to very small extent, which as they return to the fully clamped position, produces an unsightly crimp mark in the surface of the shaped can. The only way we can overcome this is physically to clamp the mould shut which if successful, produces our second problem. In this latter case, the can is caused to expand, but the open extremity of the can is clamped tightly by the closure member. Thus, as the can expands, the extremity is clamped against any movement with a result that there is, on some cans produced using the Continental Can machine, a small tear or disconformity results towards the open end of the shaped can.

Furthermore, the successful clamping of the mould necessitates the use of a circular clamp which means that the machine can only be used as a batch device or in conjunction with a complex mechanism to unlock the clamp.

We have now designed a machine which will shape cans and which overcomes the disadvantages of the Continental Can machine. In our machine, as in the Continental Can Machine, the mould is made in two parts. As shown in the enclosed drawings, each mould half in Fig 1 is supported by a mould carriage, 10, and has a pair of lugs 11, each of which engages with an inclined recess 12. The base of the mould is formed by a mould baseplate 13, carried by a ramrod 14. You can see therefore that when the cylindrical can blank has been shaped, the closure assembly 50 withdrawn, and the ramrod extended (rightwards in Figure 1), the thrust plate 15 pushes the two mould halves and their associated carriages rightwards. Since the lugs are constrained within their respective recesses 12, the carriages and the mould halves carried thereby move apart progressively as they are urged rightwards by the ram rod 14 thus allowing for removal of the shaped can from the mould. The shaped can is then removed from the mould and a fresh blank is inserted in the lower mould half ready for the next moulding cycle. The beauty of this arrangement is that when the mould is closed and the combustion is effected, the pressure acting within the mould produces a component of force acting on the carriages which tends to **tighten** the two mould halves, thereby preventing the marking of the can body during shaping. (Figure 2 is the section A-A in Figure 1)

The closure assembly 50 has an annular seal 51 adapted to enter the open end of the can blank, and is provided with air and fuel inlets 52 and 53 respectively. An automobile spark plug 55 provides the ignition means. Closure assembly 50 is carried by several threaded bolts 60, and is spring-biased towards the mould by means of compression springs 61, the spring loading being adjustable by means of the bolts 60. The closure assembly has a rightward extension piece part of which is indicated at 70 which carries an adjustment bolt 71. Bolt 71 is juxtaposed stop 72. The clearance between the end of bolt 71 and the stop 72 is adjustable. Thus the whole closure assembly is spring-loaded from body 80 towards the mould.

When combustion occurs, the sudden increase in pressure causes the closure assembly to move rightwardly against the loading of springs 61 until the bolt 71 abuts stop 72. The extent of the movement is only very slight, of the order of 0.030", but the movement over the period when the blank is undergoing deformation to take up the shape of the mould is sufficient to break the friction between the open end of the blank clamped between the seal 51 and the adjacent part of the mould, thus allowing the forming can blank to "relax" to its new shape without producing a stressed portion between the newly-shaped body and a part of the blank firmly clamped between the closure assembly and the mould. We have found that this arrangement prevents damage to blank during forming.

We have found that the best fuel is ethylene. The intensity of the forming operation can be controlled by controlling the nature and duration of the "burn" during combustion. A "high" pressure may be obtained by using enriched fuel and oxygenated air. Alternatively a "burn" of lower intensity may be obtained by introducing a diluent such as nitrogen into the fuel mixture

The machine shown in the drawings can of course be automated. We are working on this now and we expect this will be the subject of further patent applications in the near future.

One of the shapes that we can make with this machine is a can having a slightly tapered body. The standard can blank is shown in Figure 3, and the slightly tapered can body is shown in Figure 4. This shaped can body enables a number of similarly shaped cans to be nested one within another, so that "sticks" of 20 or 30 cans can be produced for packing and transport. This arrangement provides for a much more efficient use of transport; furthermore the "sticks" of cans are susceptible to the use of automated machinery to loading of the individual cans on to the canning line at the cannery. We have found that the best results for the can are obtained when the angle θ (see Figure 3) is between 1°23' and 2°18'. This ensures that the decorated surfaces of the shaped cans are not damaged during handling and separation. Incidentally, one other advantage of this machine is that we can decorate the cylindrical blanks **before** shaping and provided that the final shape is not too convoluted or extreme, no significant distortion of the decoration will be noticed.

I think that this is a major development in the art of canning machinery and I shall be please if you will prepare and file a patent application as soon as possible."

You are asked to:-

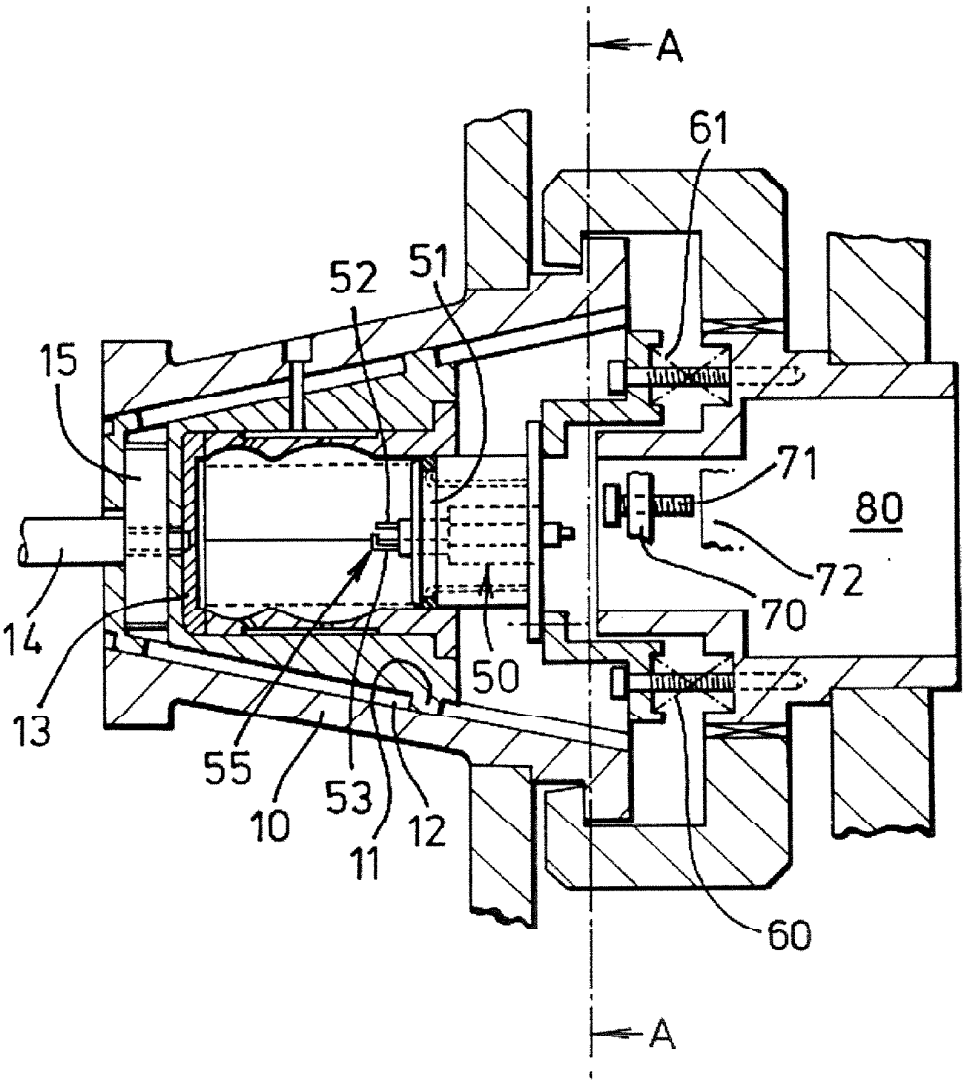
1 Draft claims for filing in the UK Patent Office to protect your client's interests.

(80 marks)

2 Prepare a note to your client explaining why you have prepared the claims in the way that you have.

(20 marks)

FIG. 1



RÉPUBLIQUE FRANÇAISE

MINISTÈRE DE L'INDUSTRIE

SERVICE
de la PROPRIÉTÉ INDUSTRIELLE

BREVET D'INVENTION

P.V. n° 912.572 N° 1.342.377

Classification internationale : B 23 *p*

Procédé et dispositif de refaçonnage par explosion d'objets creux ductiles.

Société dite : CONTINENTAL CAN COMPANY, INC. résidant aux États-Unis d'Amérique.

Demandé le 17 octobre 1962, à 16h 45m, à Paris.
Délivré par arrêté du 30 septembre 1963.
(*Bulletin officiel de la Propriété industrielle*, n° 45 de 1963.)

(*Demande de brevet déposée aux États-Unis d'Amérique le 25 avril 1962, sous le n° 190.029, au nom de* M. Curtis Eugene MAIER.)

FIG.3

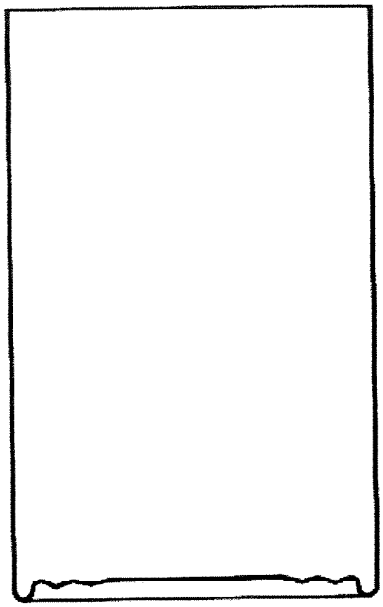


FIG.4

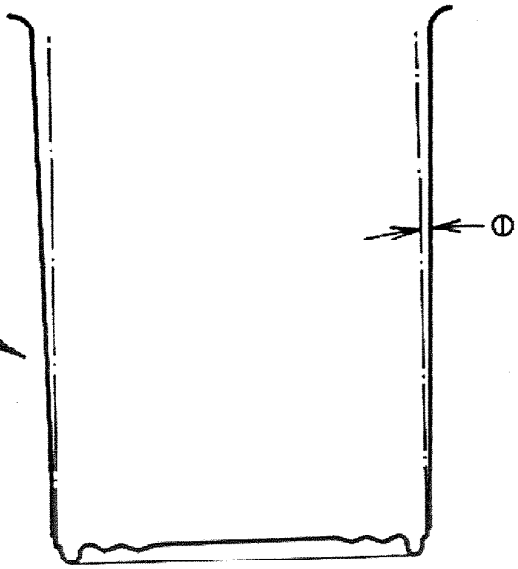
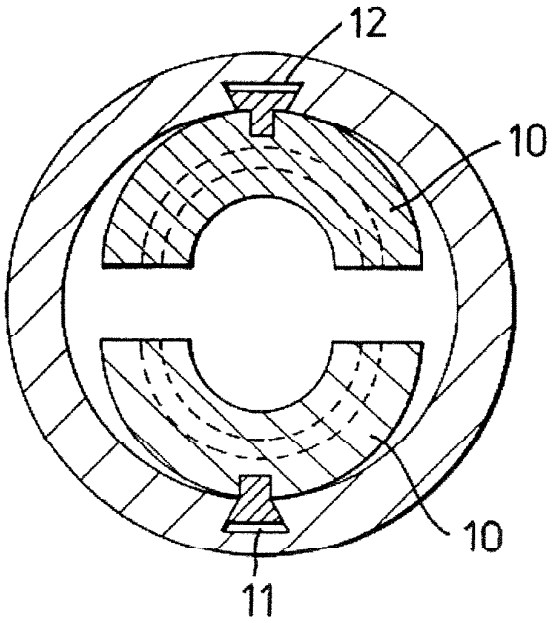


FIG. 2



N° 1.342.377 Société dite : 4 planches. - Pl. I

Continental Can Company, Inc.

FIG.1

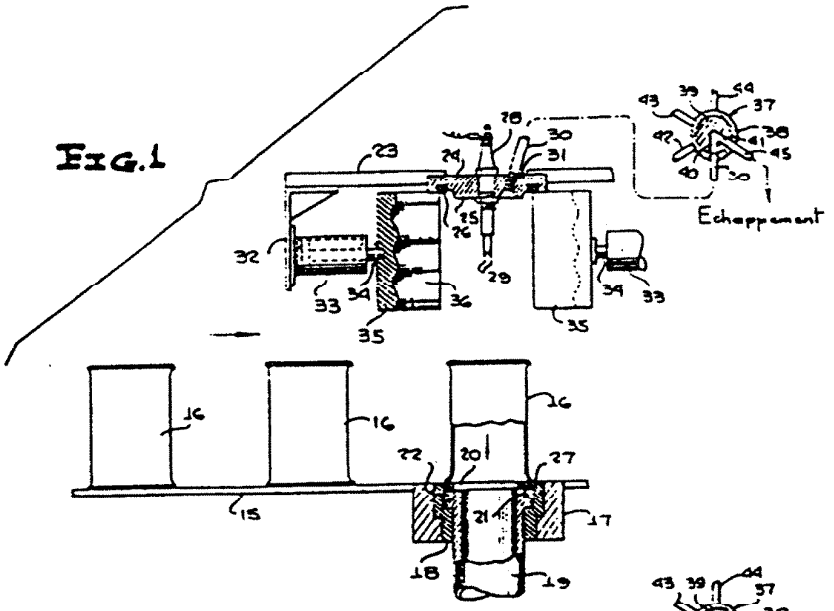


FIG.2

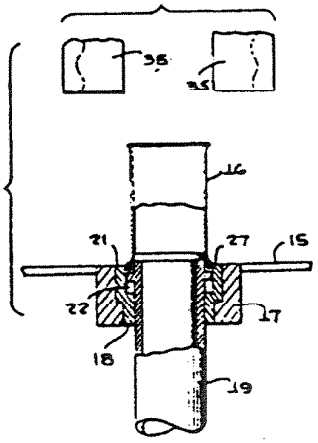
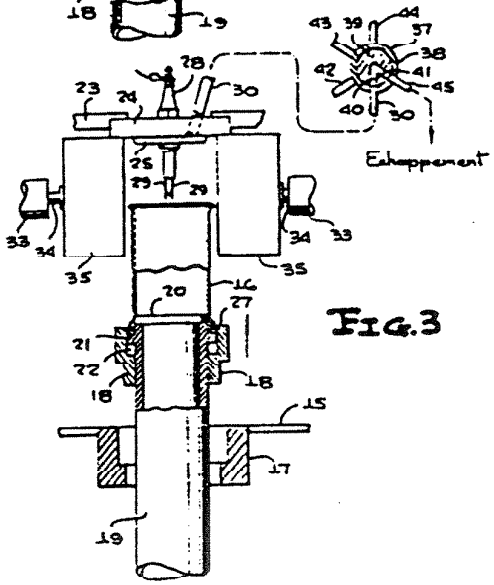


FIG.3



N° 1.342.377 Société dite : 4 planches. - Pl. II

Continental Can Company, Inc.