This invention relates to the manufacture of drawn metal containers such as cartridge cases in which the length is great in relationship to the diameter, and the thickness of the base is great in relationship to the thickness of the body walls.

Cartridge cases of the type in question are normally made of high grade brass and in one piece from the comparatively thick blank of small diameter, the thickness of which is substantially the same as the thickness of the base of the finished case. Commencing by drawing by thick walls and base, such cup is successively drawn to retain the thick based cup and produce medium thickness walls, and is then ironed by progressively smaller dies and punches which, whilst retaining the thick base, produce, by plastic flow, the required thin walls whose depth is great in relationship to its diameter. The pressures involved in this process, even with a relatively ductile metal such as high grade brass are very high so that the die life is short, and the amount of wall thinning which takes place on each passage through the dies is necessarily small due to the need for keeping these pressures within reasonable limits. Annealing where necessary takes place between draws, or passes through the dies, and in some instances the length of the cup walls is adjusted after one operation by facing the open end to suit a following operation.

Another object of the invention is the manufacture of a cartridge case or like container which comprises a ferrous metal case and a ferrous metal body formed with complementary fitting and locating surfaces and secured together by welding at such surfaces.

According to further features of the invention a non-ferrous fusible metal, preferably copper, may be used to produce the weld and the container may subsequently be subjected to "drawing" so as to stress the weld and provide a test for the strength thereof. Preferably the body part is produced by "drawing" and the base by "coining," and the parts are shaped and/or positioned so as to form an annular channel in which the welding metal is trapped or held before and during fusing. In one mode of carrying out the invention, the parts so formed and positioned are arranged and heated so that the jointing metal flows into the joint, when it is fused, the welded parts being preferably subsequently processed. In connection with cartridge cases the weld is preferably located away from what is known as "the point of separation," that is the point where breakage usually occurs, if at all, as a result of explosion pressures.

In the accompanying drawings, Figs. 1 to 5 show in various stages of production a "drawn" steel body for a cartridge case made in accordance with one example of the invention.

Figs. 6 to 9 show a "coined" steel base in various stages of production for fitting to the body Fig. 5.

Fig. 10 shows the fitting together of the parts shown in Figs. 5 and 9 prior to welding.

Fig. 11 shows the finished cartridge case.

In the manufacture of the body shown in Figs. 1 to 5 of the drawing, a cup a is drawn from a circular steel blank, the diameter of which is chosen in accordance with the known rules for cup drawing, and the thickness of which is slightly greater than the thickness required in the finished wall. Figs. 1, 2 and 3 show the first draws, while Fig. 4 shows a further draw which also includes some degree of ironing to reduce the wall thickness and give the necessary tapering of this thickness. Annealing as required may be performed between these stages of drawing, but is usually necessary only after the initial blank and draw as shown in Fig. 1. By appropriate selection of the original blank diameter, trimming to length may be rendered unnecessary during these stages. The bottom b of the resulting cup is now removed, preferably by piercing, leaving the tubular body c as shown in Fig. 5.

The base is made from the steel blank d shown in Fig. 6. The steel should be of a quality suitable for cold-working, and the blank is coined and re-coined in suitable tools and stages to give the forms d1 and d2 shown in Figs. 7 and 8 respectively. The base is then machined to the form e shown in Fig. 9. Alternatively, the base can be machined from steel bar. In its finished form the base is a press fit in the end of the body. The body c and base e are then assembled as shown in the Fig. 10, with a thin copper ring f in position as shown which will ultimately form the weld. The assembly is then passed through a conveyor-type furnace, or other suitable furnace, at a temperature high enough to fuse the copper ring and effect the welding together of the two parts. The assembly passes through the furnace in an inverted position with the open end downwards, the copper being thus able to
flow by gravity into the joint between the two parts from the trough formed by the body overlapping the base groove, and which flow seems to occur effectively, however tight a fit the joint may originally have been.

The welded assembly now receives a further draw or ironing which serves the double function of finally sizing the case, and by its attendant work-hardening, stiffening and strengthening the case after the annealing which takes place during the welding operation. The degree of hardness so obtained is dependent upon the amount of ironing which takes place during this operation. Drawing, after welding, is also performed in such manner that pressure in one direction is applied direct to the base so as to stress the copper weld and this provides a safeguard as a test of the strength of the weld.

The case is now in a condition and form similar to an advanced stage in the manufacture of the orthodox brass case, and the subsequent operations of taping, necking, trimming the mouth and machining the head may now follow normal procedure to complete the case as shown in Fig. 11.

The line 2—2 in Fig. 11 shows the approximate location of the "point of separation" and it will be seen that the weld is located away from this point.

The steel cartridge case will, of course, require a weather-proof finish, and for reasons connected with the gun itself, this finish must be metallic. This may take the form of electrically deposited chromium or other metal preferably over a sub-coating such as nickel.

This feature of chromium plating is applicable to cartridge cases of any suitable material and construction other than as above described. Chromium is selected as having an important characteristic in that the hard chromium skin reduces the effort of inserting the case into and (especially after firing) the effort of extracting the case from the breech of a gun. In consequence the strain on the gun mechanism and the risk of fracture of the cartridge case during extraction are much reduced, all of which results of selecting chromium are in excess of the normally known effects of providing a hard protective coating.

The invention is obviously not limited to all the details of construction of the example above described, many of which will be capable of modification without departing from the nature of the invention.

For example, the body part could be made from solid drawn tube instead of by blanking and drawing as herein described and the shaping produced by swaging or other manipulation, or such body could be made from welded tube or otherwise with a longitudinal weld, though there would obviously be prejudice against having such a joint. Fig. 5 may be taken to represent such a tube prepared for receiving a base.

The steel cartridge case, besides providing the immediate need for saving in non-ferrous metals, has several advantages. For instance, being made of a strong metal is an obvious advantage, but it is also harder and less liable to marking which at present is responsible for a high percentage of the rejects of brass cases due to damage during and after manufacture.

What we claim is:

1. A method of making a cartridge case comprising: forming a tubular body part, forming a circular base part having a pre-formed circumferential groove in the location of an extractor groove, placing a non-ferrous metal ring in said circumferential groove, said ring having a lower fusion point than the said body part and base part, placing the body part on the base so that the end of said body part overlies said groove and encloses said non-ferrous metal ring, heating the assembled body and base parts in inverted position whereby the non-ferrous ring is heated to fusion and flows between and unites the adjacent surfaces, and forming an extractor groove around said base part by machining away at least that part of the body which overlies said pre-formed groove.

2. A method of making a cartridge case comprising: forming a tubular ferrous body part, forming a circular ferrous base part having a pre-formed circumferential groove in the location of an extractor groove, placing a non-ferrous metal ring in said circumferential groove, said ring having a lower fusion point than the said body part and base part, placing the body part on the base so that the end of said body part overlies said groove and encloses said non-ferrous metal ring, heating the assembled body and base parts in inverted position whereby the non-ferrous ring is heated to fusion and flows between and unites the adjacent surfaces, and forming an extractor groove around said base part by machining away at least that part of the body which overlies said pre-formed groove.

3. A method of making a cartridge case comprising: forming a tubular steel body part, forming by operations including an initial coining operation, a circular steel base part having a pre-formed circumferential groove in the location of an extractor groove, placing a copper ring in said circumferential groove, said ring having a lower fusion point than the said body part and base part, placing the body part on the base so that the end of said body part overlies said groove and encloses said copper ring, heating the assembled body and base parts in inverted position whereby the copper ring is heated to fusion and flows between and unites the adjacent surfaces, and forming an extractor groove around said base part by machining away at least that part of the body which overlies said pre-formed groove.