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(54) Method for producing a gun cartridge casing and multiple station transfer press for carrying out the method

(57) The present invention relates to a novel method for producing a gun cartridge casing in a single multiple station deep drawing transfer press without any intermediate washing, pickling and/or bondering steps

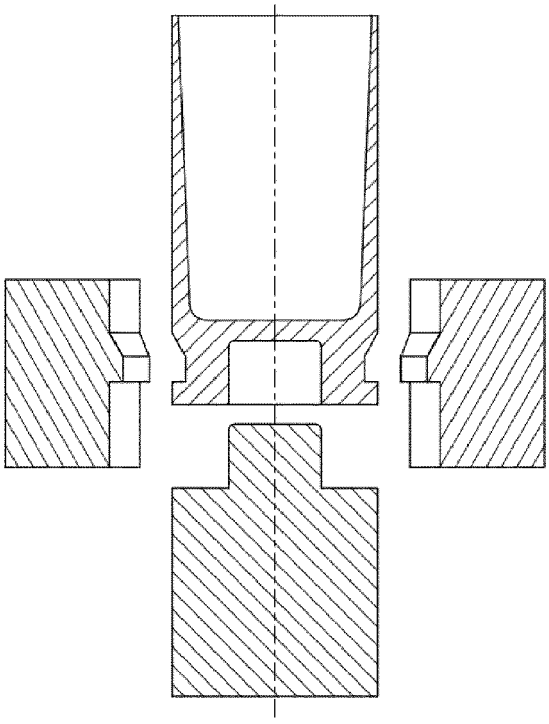

Fig. 2

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Description

[0001] The present invention relates to a novel method for producing a gun cartridge casing.

Background of the invention

[0002] Typically gun cartridge cases are drawn from sheet metal discs in three 'stages'. First a cup is formed from the sheet metal disc. Thereafter the cup is drawn to the desired length by a number of forming operations through punches of decreasing diameters until a suitable length of the part is attained. The drawn part is then provided with a neck, if necessary. Finally, the bottom of the drawn and necked part is provided with a groove to form the final cartridge case.

[0003] After each drawing stage the parts are annealed, pickled, rinsed and subjected to further quality improvement measures.

[0004] For the annealing process the part should be clean, which requires a washing before the annealing. After the annealing the part is pickled, bondered and/or lubricated, which is required for the following drawing operations.

[0005] Depending on the calibre, the drawing process is typically carried out in a transfer press, where the product is deep drawn in a number of sets comprising pairs of punches and dies (stations) to receive workpieces leaving a deep drawn tool. If the drawing is carried out in a transfer press, the transport is accomplished by using mechanical grippers.

[0006] Normally a transfer press comprises 5 to 12 stations. Due to the heavy reduction in strength of the sheet, usually from an initial strength of about 3 to 4 mm to final strength of about 0.3 mm, the material is hardened. Further, the forming capability is reduced with every step. Therefore, the processes according to the state of the art require at least one further intermediate annealing process (incl. washing and pickling), sometimes depending on the calibre even more.

[0007] After the ironing process in the transfer press there is necking process for most of the rifle cartridges. The necking is done after an annealing process to reduce the material stress before this critical forming process. Typically the necking is done in 2 stations.

[0008] The groove and trim are formed using special equipment, which is separate from transfer press. For this to be achieved, the case is fixed in a collet chuck and turned while a shaped turning tool cuts the groove and a second one trims the length.

[0009] It will readily be realised that such processes are laborious, costly, and require costly investments.

Summary of the Invention

[0010] It is therefore an object of the present invention to provide a method for producing a gun cartridge casing which can be performed on a single transfer press.

[0011] There is provided a method for manufacturing a gun cartridge casing comprising the steps of:

(a) providing a metal sheet to a multiple station deep drawing transfer press which comprises a blanking device for cutting blanks out of the metal sheet;
(b) cutting a metal blanket of said metal sheet;
(c) transferring said metal blanket obtained in step (b) to a first forming station which comprises a punch and a die, wherein said metal disc sheet is formed into a metal cup;
(d_1) transferring said metal cup obtained in step (c) to a second set of forming stations comprising a number of punches and dies, wherein said metal cup is deep drawn into an cartridge case; and
(e_1) releasing said cartridge case from the multiple station deep drawing transfer press,

wherein between steps (a) and (e_1), there are no intermediate washing, pickling and/or bondering steps.

[0012] In an embodiment of the invention, the steps (b) of producing a blank from a metal sheet, and (c) of producing a cup are carried out in one cutting and forming station.

[0013] If the cartridge case is to be provided with a groove, it is advantageously produced in a method for manufacturing a gun cartridge casing having a groove in a single multiple station deep drawing transfer press comprising the steps of:

(d_2) providing a metal cup to a set of forming stations in a multiple station deep drawing transfer press comprising a number of punches and dies, wherein said metal cup is deep drawn into a cartridge case; and
(e_2) transferring said metal cup obtained from step (d_2) to a further forming station comprising a punch and a die, wherein the diameter of the bottom of said cartridge case is reduced to the required groove diameter;
(f_1) transferring said cartridge case having a bottom of reduced diameter obtained in step (e_2) to a further forming station comprising a punch and a die to form a groove, wherein the die is a splitted die which can be opened after operation; and
(g_1) opening the splitted die and releasing the cartridge case provided with a groove from the multiple station deep drawing transfer press,

wherein between steps (d_2) and (g_1), there are no intermediate washing, pickling and/or bondering steps.

[0014] Preferably, also the steps of cutting blanks of a metal sheet and forming a cup of the metal sheet are carried out in the same multiple station deep drawing transfer press in a sequence comprising the following steps:

(a) providing a metal sheet to a multiple station deep

drawing transfer press which comprises a blanking device for cutting blanks out of the metal sheet;
(b) cutting a metal blanket of said metal sheet;
(c) transferring said metal blanket obtained in step (b) to a first forming station which comprises a punch and a die,

wherein said metal disc sheet is formed into a metal cup; whereupon the cup is transferred to step (d_2), wherein between steps (a) and (g_1), there are no intermediate washing, pickling and/or bondering steps.

[0015] Some cartridge cases, particularly those used in rifles, require the presence of a neck. Also the neck is advantageously produced within the same multiple station deep drawing transfer press after step in a method for manufacturing a gun cartridge casing having a neck in a single multiple station deep drawing transfer press comprising the steps of:

(d_3) providing a metal cup to a set of forming stations in a multiple station deep drawing transfer press comprising a number of punches and dies, wherein said metal cup is deep drawn into a cartridge case; and
(e_3) transferring said cartridge case obtained in step (d_3) to a further forming station, wherein said cartridge case is provided with a neck;
(f_2) and releasing the cartridge case from the multiple station deep drawing transfer press,

wherein between steps (d_3) and (f_2), there are no intermediate washing, pickling and/or bondering steps.

[0016] Preferably, also the steps of cutting blanks of a metal sheet and forming a cup of the metal sheet are carried out in the same multiple station deep drawing transfer press in a sequence comprising the following steps:

(a) providing a metal sheet to a multiple station deep drawing transfer press which comprises a blanking device for cutting blanks out of the metal sheet;
(b) cutting a metal blanket of said metal sheet;
(c) transferring said metal blanket obtained in step (b) to a first forming station which comprises a punch and a die,

wherein said metal disc sheet is formed into a metal cup; whereupon the cup is transferred to step (d_3), wherein between steps (a) and (f_2), there are no intermediate washing, pickling and/or bondering steps.

[0017] If a cartridge case having a groove and a neck is to be produced, then it may be produced in a method for manufacturing a gun cartridge casing having a neck in a single multiple station deep drawing transfer press comprising the steps of:

(d_4) providing a metal cup to a set of forming stations in a multiple station deep drawing transfer press comprising a number of punches and dies, wherein said metal cup is deep drawn into a cartridge case; and
(e_4) transferring said cartridge case obtained from step (d_4) to a further forming station comprising a punch and a die, wherein the bottom of said cartridge case is reduced to the required groove diameter;
(f_3) transferring said cartridge case provided with a reduced bottom obtained in step (e_2) to a further forming station comprising a punch and a die to form a groove, wherein the die is a splitted die which can be opened after operation; and;
(g_2) opening the splitted die and transferring said cartage case provided with a groove obtained in step (f_2) to a further forming station, wherein said elongated metal cup is provided with a neck; and
(h_1) releasing the cartridge case from the multiple station deep drawing transfer press

wherein between steps (d_4) and (h_1), there are no intermediate washing, pickling and/or bondering steps.

[0018] Preferably, also the steps of cutting blanks of a metal sheet and forming a cup of the metal sheet are carried out in the same multiple station deep drawing transfer press in a sequence comprising the following steps:

(a) providing a metal sheet to a multiple station deep drawing transfer press which comprises a blanking device for cutting blanks out of the metal sheet;
(b) cutting a metal blanket of said metal sheet;
(c) transferring said metal blanket obtained in step (b) to a first forming station which comprises a punch and a die,

wherein said metal disc sheet is formed into a metal cup; whereupon the cup is transferred to step (d_4), wherein between steps (a) and (h_1), there are no intermediate washing, pickling and/or bondering steps.

[0019] If the cartridge case is to be equipped with a neck, such as in many rifle cartridge cases, it is desirable to produce it in the same multiple station deep drawing transfer press as all previous steps. In said machine, the neck is preferably produced at the very end of the process. Pistol cartridge cases are normally not provided with a neck.

[0020] A forming station in the multiple station deep drawing transfer press usually comprises a pair of a punch and a die where the metal sheet is formed, first into a metal cup, and subsequently into a cartridge case with elongated form in relation to the metal cup, a stripper, an ejecter and a gripper which transports the cup of cartridge case from one forming station to the next one. In case a neck is formed, the forming station does not comprise a punch. There is just a die which forms a neck on the open side of the cartridge case and an inner pilot to maintain the wall thickness.

[0021] According to the present invention there is also

provided a multiple station deep drawing transfer press for manufacturing a gun cartridge casings in a single machine, which comprises a cutting device for cutting discs out of a metal sheet and a number of forming stations for drawing and forming said metal discs, wherein in at least one forming station comprising a punch and a die, the die exhibits a splitted punch to form a groove.

Detailed Description of the Preferred Embodiments

[0022] According to the present invention, the metal sheet, which is preferably a brass sheet, is fed directly into a deep drawing transfer press. Preferably a zig-zag feeder for providing a multiple cut is used to feed the material to the cutting tool which cuts discs out of sheet metal. A zig-zag feeder will utilize the material in a most efficient manner without needless waste of material.

[0023] Thereafter, a cup is formed in the transfer press, and the cup is transferred to subsequent stations of the transfer press, preferably without any intermediate washing, pickling and/or bondering. During various forming steps, the wall thickness of the case is reduced to a final wall thickness.

[0024] To allow the further deep drawing and ironing operations without any annealing process to the final wall thickness, a reduction of the true strain of per operation is required. Preferably, according to the process of the present invention, the number of forming stations (pairs of punches and dies) is higher than in known processes. Preferably, the multiple station deep drawing transfer press used in the method according to the present invention comprises 12 to 25, preferably 15 to 25 forming stations in total. For Example, to include a neck, without any intermediate annealing step, the number of forming stations used for step (e_3) is preferably from three to seven, most preferably from four to five.

[0025] In step (c) the cup is preferably formed in one forming station, where the thickness of the metal is preferably reduced by 40% to 70% while a cup is formed.

[0026] Preferably, the number of forming stations for carrying out drawing and forming steps (d) of the cup to form a cartridge case is from three to nine, more preferably from four to eight, such as from five to seven. In these forming stations, the wall thickness of the cup or of the intermediately drawn cases is preferably reduced by a higher percentage during the earlier stages of the drawing process of step (d) than in later stages of the step (d). For Example, according to a preferred embodiment the wall thickness of the cup is reduced by 30% to 50%, more preferably about 40% in a first forming station of step (d). While normally the reduction is about 60% to 70%.

[0027] According to a further preferred embodiment, the wall thickness of the drawn case is reduced in a second forming station of step (d) by a lower percentage than in a first forming station of step (d). Preferably, the wall thickness of the drawn case is reduced by 20% to 30% in a second forming station of step (d).

[0028] According to a still further preferred embodiment, the wall thickness of the drawn case is reduced in a third forming station of step (d) by a lower percentage than in a second forming station of step (d). Preferably, the wall thickness of the drawn case is reduced by 10% to 25%, preferably 10% to 20% in a third forming station of step (d). While normally the reduction is about 25% to 35%.

[0029] According to a still further preferred embodiment, the wall thickness of the drawn case is reduced in a fourth and any further forming station of step (d) by an equal or a lower percentage than in a third forming station of step (d). Preferably, the wall thickness of the drawn case is reduced by 10% to 20% in a fourth or any further forming station of step (d).

[0030] With the increasing number of forming stations and therefore with increasing bed size, the forming and coining force increases which may result in a winkling of the punch. The press force, depending on the caliber of the gun cartridge case, is preferably chosen between 75 to 250 tons, and a bed length is preferably from of 1000 to 3000 mm. Preferably, a ridged mechanical press or ideally a servo spindle press is used, which can actively correct the punch winkling.

[0031] Preferably, one or two flash holes are pierced in the drawn case within the deep drawing transfer press.

[0032] As described above, according to the state of the art, the grooving process is typically carried out in an external operation, in a turning method, wherein material is removed from the blank. The method according to the present invention, however, for the first time integrates the grooving steps in a transfer press, and does not remove material while the groove is formed.

[0033] The groove is formed in two steps. For forming the groove, the first operation is a drawing operation where the bottom of the case is reduced in diameter to the required groove diameter. In a further station in the deep drawing transfer press, the bottom of the case is held with a splitted punch, then, the bottom and primer pocked are coined into the case. The material flows radially and, thus, the groove is formed. To release the case of the splitted punch, the punch is opened into its segments.

[0034] This is further demonstrated by appending Figures 1 and 2, which are a cross-sectional view of a splitted punch according to the present invention in closed state (Fig. 1), and in opened state (Fig. 2), respectively.

Claims

1. A method for manufacturing a gun cartridge casing in a single multiple station deep drawing transfer press comprising the steps of:

   (a) providing a metal sheet to a multiple station deep drawing transfer press which comprises a blanking device for cutting blanks out of the met-

al sheet;
(b) cutting a metal blanket of said metal sheet;
(c) transferring said metal blanket obtained in step (b) to a first forming station which comprises a punch and a die, wherein said metal disc sheet is formed into a metal cup;
(d_1) transferring said metal cup obtained in step (c) to a second set of forming stations comprising a number of punches and dies, wherein said metal cup is deep drawn into an cartridge case; and
(e_1) releasing said cartridge case from the multiple station deep drawing transfer press,

wherein between steps (a) and (e_1), there are no intermediate washing, pickling and/or bondering steps.

2. A method for manufacturing a gun cartridge casing having a groove in a single multiple station deep drawing transfer press comprising the steps of:

(d_2) providing a metal cup to a set of forming stations in a multiple station deep drawing transfer press comprising a number of punches and dies, wherein said metal cup is deep drawn into a cartridge case; and
(e_2) transferring said metal cup obtained from step (d_2) to a further forming station comprising a punch and a die, wherein the diameter of the bottom of said cartridge case is reduced to the required groove diameter;
(f_1) transferring said cartridge case having a bottom of reduced diameter obtained in step (e_2) to a further forming station comprising a punch and a die to form a groove, wherein the die is a splitted die which can be opened after operation; and
(g_1) opening the splitted die and releasing the cartridge case provided with a groove from the multiple station deep drawing transfer press,

wherein between steps (d_2) and (g_1), there are no intermediate washing, pickling and/or bondering steps.

3. The method according to claim 2, comprising the steps of:

(a) providing a metal sheet to a multiple station deep drawing transfer press which comprises a blanking device for cutting blanks out of the metal sheet;
(b) cutting a metal blanket of said metal sheet;
(c) transferring said metal blanket obtained in step (b) to a first forming station which comprises a punch and a die, wherein said metal disc sheet is formed into a metal cup;

whereupon the cup is transferred to step (d_2), wherein between steps (a) and (h_1), there are no intermediate washing, pickling and/or bondering steps.

4. A method for manufacturing a gun cartridge casing having a neck in a single multiple station deep drawing transfer press comprising the steps of:

(d_3) providing a metal cup to a set of forming stations in a multiple station deep drawing transfer press comprising a number of punches and dies, wherein said metal cup is deep drawn into a cartridge case; and
(e_3) transferring said cartridge case obtained in step (d_3) to a further forming station, wherein said cartridge case is provided with a neck;
(f_2) and releasing the cartridge case from the multiple station deep drawing transfer press,

wherein between steps (d_3) and (f_2), there are no intermediate washing, pickling and/or bondering steps.

5. The method according to claim 4, comprising the steps of:

(a) providing a metal sheet to a multiple station deep drawing transfer press which comprises a blanking device for cutting blanks out of the metal sheet;
(b) cutting a metal blanket of said metal sheet;
(c) transferring said metal blanket obtained in step (b) to a first forming station which comprises a punch and a die, wherein said metal disc sheet is formed into a metal cup;

whereupon the cup is transferred to step (d_3), wherein between steps (a) and (f_2), there are no intermediate washing, pickling and/or bondering steps.

6. A method for manufacturing a gun cartridge casing having a neck in a single multiple station deep drawing transfer press comprising the steps of:

(d_4) providing a metal cup to a set of forming stations in a multiple station deep drawing transfer press comprising a number of punches and dies, wherein said metal cup is deep drawn into a cartridge case; and
(e_4) transferring said cartridge case obtained from step (d_4) to a further forming station comprising a punch and a die, wherein the bottom of said cartridge case is reduced to the required groove diameter;
(f_3) transferring said cartridge case provided with a reduced bottom obtained in step (e_2) to a further forming station comprising a punch and a die to form a groove, wherein the die is a split-

ted die which can be opened after operation; and;

(g_2) opening the splitted die and transferring said cartage case provided with a groove obtained in step (f_2) to a further forming station, wherein said elongated metal cup is provided with a neck; and

(h_1) releasing the cartridge case from the multiple station deep drawing transfer press

wherein between steps (d_4) and (h_1), there are no intermediate washing, pickling and/or bondering steps.

7. The method according to claim 6, comprising the steps of:

(a) providing a metal sheet to a multiple station deep drawing transfer press which comprises a blanking device for cutting blanks out of the metal sheet;

(b) cutting a metal blanket of said metal sheet;

(c) transferring said metal blanket obtained in step (b) to a first forming station which comprises a punch and a die, wherein said metal disc sheet is formed into a metal cup;

whereupon the cup is transferred to step (d_3), wherein between steps (a) and (h_1), there are no intermediate washing, pickling and/or bondering steps.

8. The method of any of the previous claims, wherein the metal sheet is of brass.

9. The method of any of the previous claims, wherein said multiple station deep drawing transfer press comprises 12 to 25, preferably 15 to 25 pairs of punches and dies in total.

10. The method of any of the previous claims, wherein said third set comprises three to five pairs of punches and dies for carrying out step (e).

11. The method of any of the previous claims, wherein said multiple station deep drawing transfer press develops a press force between 75 and 250 tons.

12. The method of any of the previous claims, wherein said multiple station deep drawing transfer press has a bed length between 1000 and 3000 mm.

13. The method of any of the previous claims, wherein said multiple station deep drawing transfer press comprises a servo spindle press which actively corrects punch wrinkling.

14. Multiple station deep drawing transfer press for manufacturing a gun cartridge casings in a single machine, which comprises a cutting device for cutting discs out of the metal sheet and a number of pairs of punches and dies for drawing said metal discs, wherein in at least one pair of a punch and a die, the die exhibits a splitted punch to form a groove.

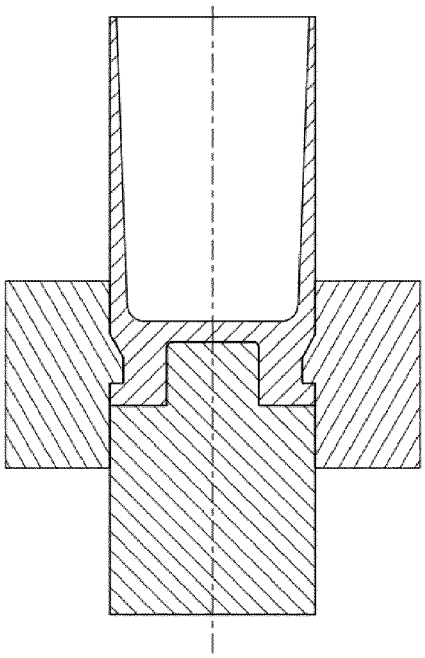

Fig. 1

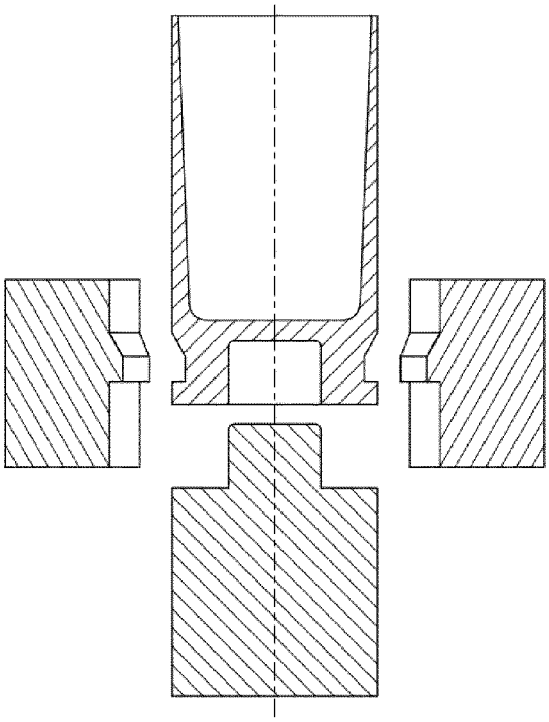

Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 13 16 2784

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 3 408 718 A (WILLIAM WEAVER LAZELLE) 5 November 1968 (1968-11-05)	1,4,5	INV. B21D51/54
Y	* the whole document *	2,3,6-14	F42B5/28 B21D22/26

X	US 2 397 370 A (HENRY RAVEN WILLIAM ET AL) 26 March 1946 (1946-03-26)	1,4,5	B21K21/04
A	* the whole document *	2,3,6-14	

X	GB 433 829 A (ORESTE BIGINELLI) 21 August 1935 (1935-08-21)	1,4,5	
A	* the whole document *	2,3,6-14	

Y	FR 2 544 068 A1 (LACHAUSSEE SA ETS [BE]) 12 October 1984 (1984-10-12)	2,3,6-14	
A	* page 3, line 28 - page 4, column 10; figures 1A-1D,5 *	1,4,5	

TECHNICAL FIELDS SEARCHED (IPC)

B21D
F42B
B21K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	24 January 2014	Vinci, Vincenzo

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

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Application Number
EP 13 16 2784

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 13 16 2784

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1, 4, 5

   Independent claims 1 and 4 relate to methods for manufacturing a gun cartridge in a single multistation deep drawing transfer press.

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2. claims: 2, 3, 6-14

   Independent method claims 2 and 6 and apparatus claim 14 relates to methods for manufacturing a gun cartridge casing in a single multistation deep drawing transfer press by using a least a pair of punch and die exhibiting a splitted punch to form a groove, and to an multiple station deep drawing transfer press suitable for carrying out the method respectively.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 16 2784

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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24-01-2014

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		FR 2544068 A1	12-10-1984

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82