Dec. 19, 1939. O. BIGINELLI 2,183,637

PRODUCTION OF TUBULAR METAL CASES SUCH AS CARTRIDGE CASES

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Fig.1

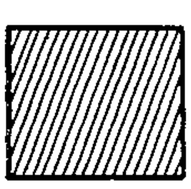

Fig.2

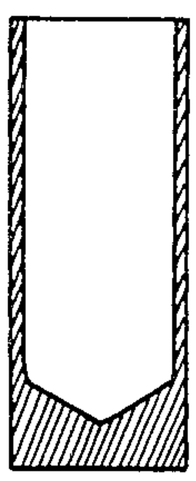

Fig.3

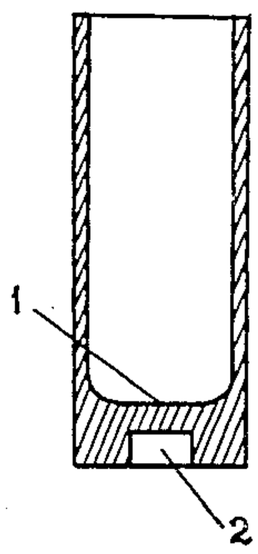

Fig.4

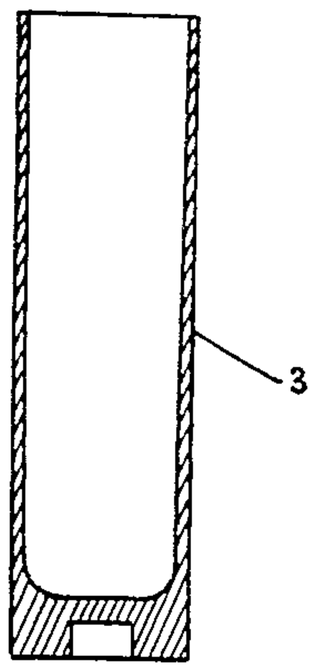

Fig.8

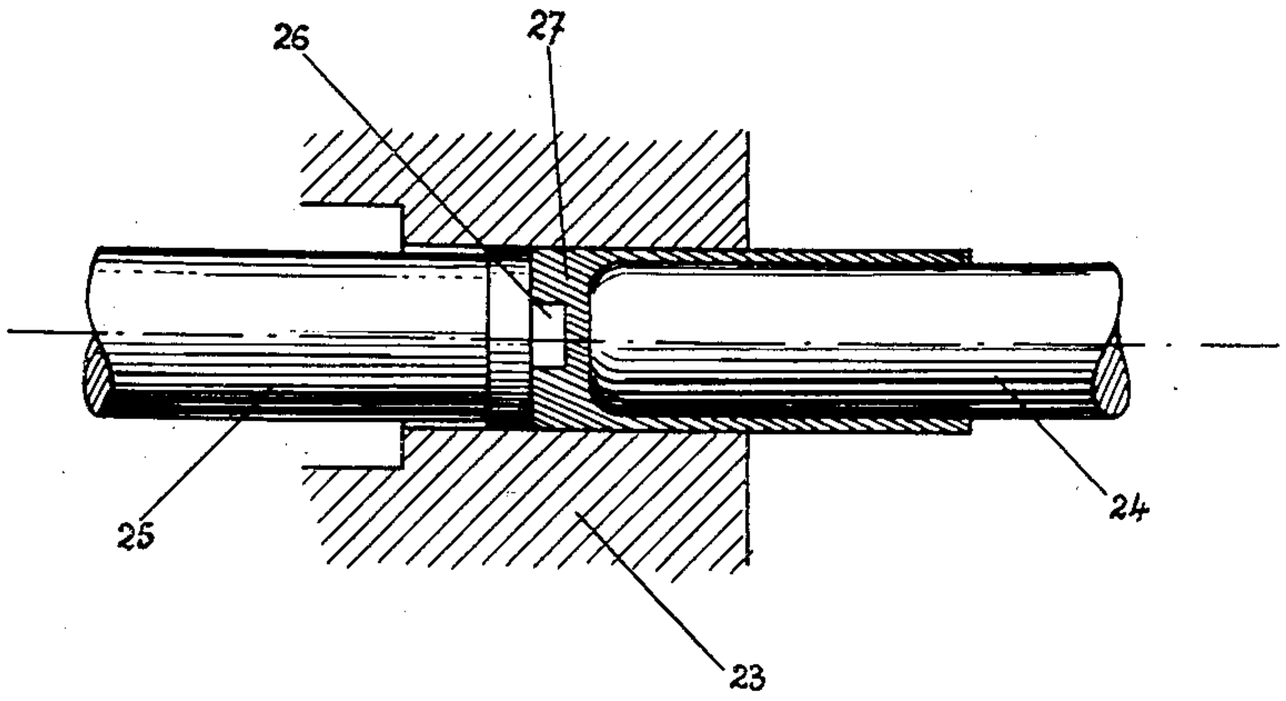

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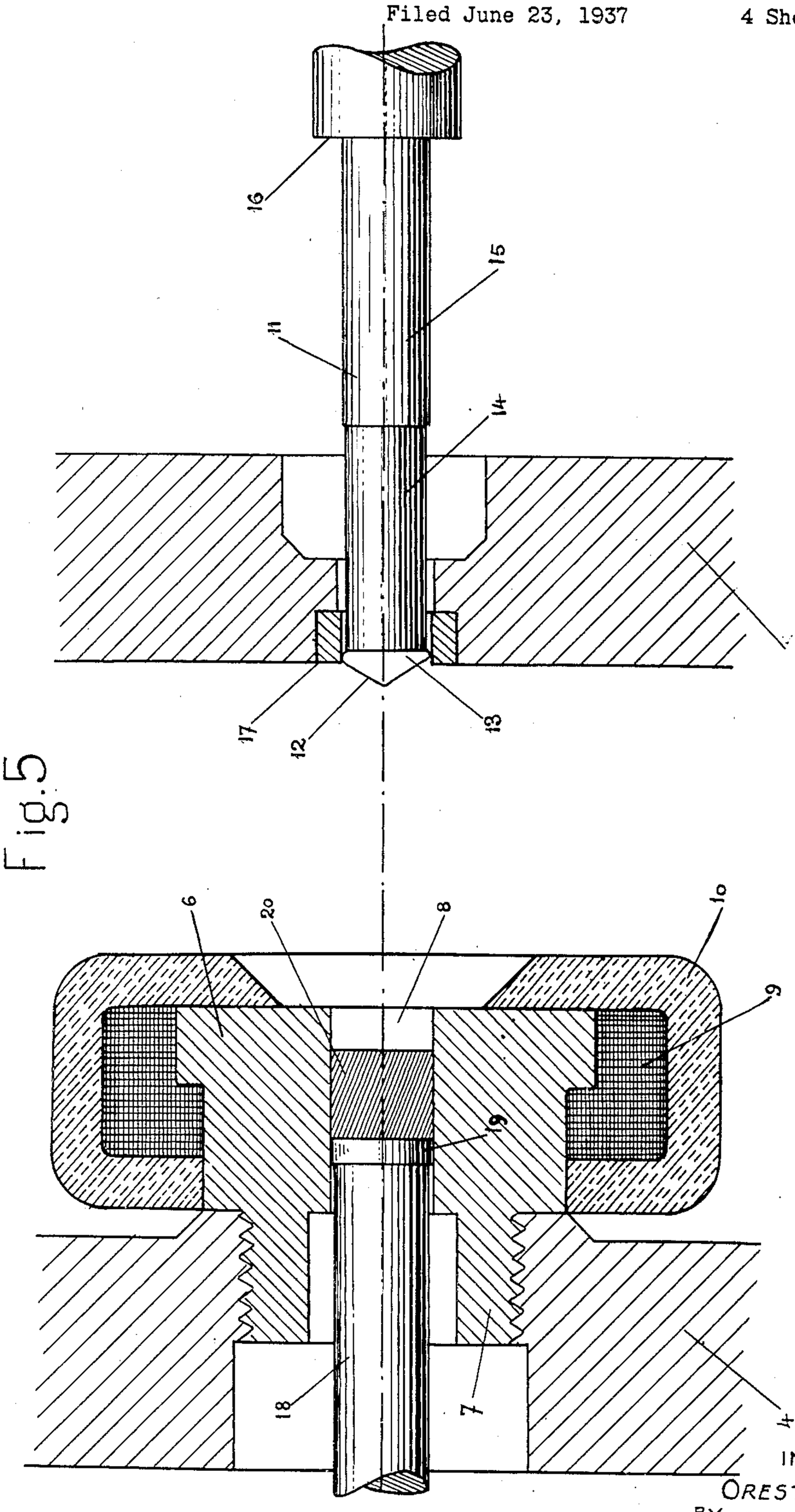
Fig. 5



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PRODUCTION OF TUBULAR METAL CASES SUCH AS CARTRIDGE CASES

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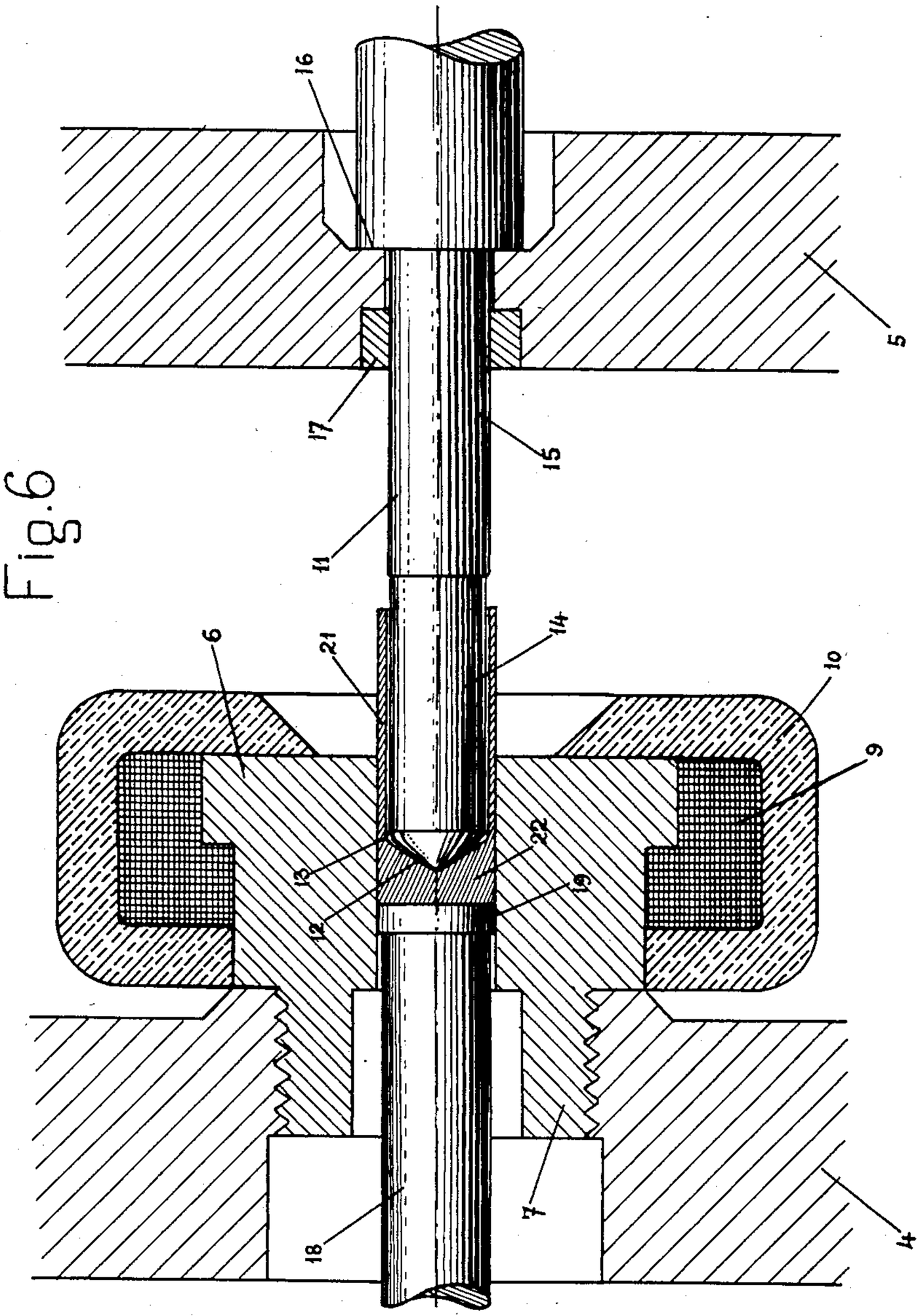
Fig.6



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PRODUCTION OF TUBULAR METAL CASES SUCH AS CARTRIDGE CASES

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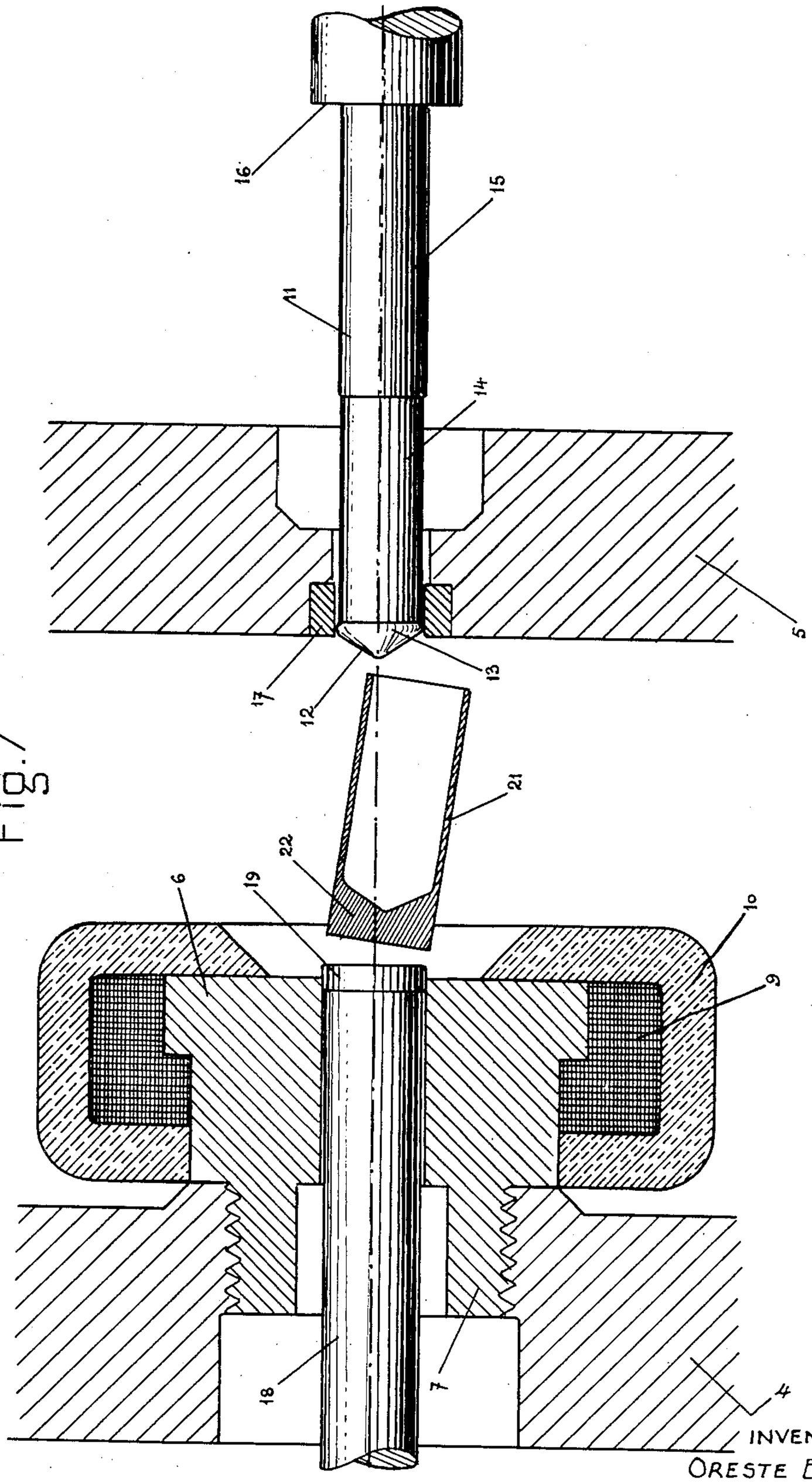
Fig. 7



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UNITED STATES PATENT OFFICE

2,183,637

PRODUCTION OF TUBULAR METAL CASES SUCH AS CARTRIDGE CASES

Oreste Biginelli, Clermont-Ferrand, France

Application June 23, 1937, Serial No. 149,856
In France August 1, 1936

2 Claims. (Cl. 29—1.3)

This invention relates to the production of tubular metal cases such as cartridge cases. In the common method of manufacturing military cartridge cases or the like the initial blank consists of a metal disc of diameter considerably greater than the ultimate diameter of the case and of thickness corresponding substantially to that of the base of the finished case. This blank is formed into the case by a series of stamping operations with intermediate annealing operations. In the first stamping operation the blank is formed into a small cup and the subsequent stamping operations are numerous.

A disadvantage of this known process is due to the necessity for using blanks of very exact dimensions. Thus, as the blanks are usually cut off from a sheet, the latter has to be carefully made and the blanks have a high cost price. The cost price is further increased on account of the waste metal left over after the blanks have been cut out. A further disadvantage is due to the number of stamping operations that are necessary and of consequent annealing operations. An object of the present invention is to provide a method in which these disadvantages are eliminated.

According to the present invention, a metal case such as a military cartridge case is formed from a solid piece of metal by extruding a tubular extension from the solid piece so as to provide a case consisting of a tube closed at one end. Conveniently, the solid metal piece may be inserted into a heated die and, after being heated to a predetermined temperature, subjected to pressure which causes part of the metal to flow between the wall of the die and a core constituted by a member which takes part in exerting the pressure on the metal. The said member is constituted by a punch and this may co-operate with a counter-punch arranged so that at the end of extrusion the space left between the punch and counter-punch is filled with metal which constitutes the base of the case.

The cross section of the initial metal piece is usually circular and its length is determined by the quantity of metal necessary for forming the case. The metal piece is inserted into a bore in the die, the diameter of the bore corresponding to that of the metal piece with a little clearance to allow it to be inserted easily. The metal piece may be heated prior to its introduction into the die or it may be inserted cold. In the latter case time has to be allowed for the metal to become sufficiently plastic and then, under the action of pressure, the tubular part of the case is extruded. When a punch and counter-punch are used the relative movement between these is stopped when the punch is at a predetermined distance from the counter-punch, that is, when the initial section has been fashioned into a case comprising both a base in the form of the space left between the punch and the counter-punch, and a tubular part.

If the base of the case obtained in the initial operation is not of the required shape, the case is subjected to a further operation in which the base of the case is forced to undergo a change in shape by a process similar to that of the first operation, i.e. between a punch and counter-punch formed in accordance with the shape of the base required and acting inside a heated die. Further, if the cross section of the wall of the tubular part of the case is not of the required form after the extrusion, the tubular part may be subjected to one or more drawing operations for the purpose of causing the wall to become, for example, tapered in cross section. A large number of drawing operations is never necessary because a case with long thin walls is obtained by the extrusion operation.

Advantages arising from the invention are as follows:

(1) The dimension of the initial metal piece does not have to be very accurate, a small error in the diameter or length of the piece appearing simply as a small variation in the length of the extruded tubular part.

(2) Very small waste of metal when the metal pieces are cut from a long bar, this waste being negligible in comparison with that in the aforementioned usual process in which blanks are cut out of a sheet.

(3) Considerable reduction in the number of steps necessary for the formation of the case, the extrusion of the tubular part giving, in a single operation, an elongated form of case which, if produced by stamping, would require in its production a large number of stamping and annealing operations.

A machine for carrying the method according to the invention into effect may be furnished with a die formed with a cylindrical bore and a punch and counter-punch arranged to move axially in the bore, the counter-punch being arranged to act as an abutment, while the punch, the diameter of which is less than the bore, acts as a core around which the metal is extruded by axial pressure applied as a result of relative movement between the punch and counter-punch. Conveniently, the punch may be formed

with a conical head of which the base is slightly wider than the body of the punch and the tip is coaxial with the body of the punch, the base of the conical head being rounded so as to provide a surface around which the metal can flow as it is extruded.

In order that the invention may be clearly understood and readily carried into effect, a method and apparatus in accordance therewith will now be described by way of example with reference to the accompanying drawings in which:

Figures 1 to 4 are transverse cross sections showing different phases in the manufacture of a cartridge case, Figure 1 showing an initial cylindrical blank, Figure 2 showing the shape of the case obtained after the cylindrical wall has been extruded, Figure 3 showing the shape of the case after the shape of the base has been modified, and Figure 4 showing the shape of the finished case.

Figures 5, 6 and 7 show a diagrammatic cross section of apparatus, in various phases of its operation, for producing a case as shown in Figure 2.

Figure 8 shows a detail of apparatus for producing a case as shown in Figure 3.

Referring to Figures 5, 6 and 7, supports 4 and 5 form parts of the framework of a press. A die 6, formed with a projection 7, screwed into the support 4, is made of heat-resisting steel capable of resisting the temperature to which the work is subjected. The work consists initially of a short metal piece of cylindrical cross section which fits into a corresponding bore 8, formed in the die 6. The diameter of the bore 8 is from $\frac{2}{10}$ to $\frac{3}{10}$ millimetres greater that that of the work. The latter is heated while in the die by means of a heating system surrounding the die and consisting, for example, of an electrical resistance 9, which is represented diagrammatically in the figures and is surrounded by a heat-insulating jacket 10. When the work has been heated sufficiently for it to become plastic it is subjected to pressure between a punch 11 and a counter-punch 18, the wall thickness of the die being sufficient to resist, without deformation, the internal pressure to which it is subjected.

The punch 11 is formed at one end with a conical head 12, the base of which is rounded and provides a flange 13. The diameter of this flange is equal to the internal diameter of the tubular wall to be extruded. Behind the head 12 the punch comprises a cylindrical part 14 of diameter very slightly less than that of the flange 13 and of length slightly greater than that of the tubular wall to be extruded. A further cylindrical part 15 is disposed behind the part 14 and is of diameter equal to that of the flange 13. The punch is formed behind the part 15 with a third cylindrical part which provides a flat shoulder 16 at right angles to the axis of the punch.

The punch 11 is moved longitudinally when the press is operated, and is shown in its outermost position in Figure 5. In this position the flange 13 is supported by a sleeve 17 in which the flange 13 fits with light friction.

The diameter of, the counter-punch 18, which is cylindrical, is less by several tenths of a millimetre than that of the bore 8, except at the end 19 which fits with light friction in this bore.

In the extruding operation the punch 11 and counter-punch 18 first take up their outermost positions, as shown in Figure 5. The work in the form of the short solid piece, of circular cross section, shown in Figure 1 is then inserted into the bore 8 so as to occupy the position shown at 20 in Figure 5. Then, after enough delay to enable the work to reach a predetermined temperature at which it becomes sufficiently plastic, the punch 11 is caused to move from the position of Figure 5 to that of Figure 6. During this movement the counter-punch 18 is rigidly buttressed so that it cannot yield as a result of the force due to the action of the punch 11. As the latter moves to the position of Figure 6 with the cylindrical part 15 sliding in the sleeve 17, the head 12 becomes embedded into the metal and the metal displaced by the head is forced to extrude through the annular space between the surface of the bore 8 and the flange 13 of the punch 11. As soon as the latter reaches the position of Figure 6 it is stopped, this position being determined by the engagement of the shoulder 16 with a corresponding surface on the support 5.

Thus, as Figure 6 indicates, a case in the shape of that shown in Figure 2 is obtained, the base 22 of the case being moulded to fit exactly the space between the head 12 of the punch and the end of the counter-punch.

Figure 7 shows how the case 21, after formation, is ejected from the die. From this figure it will be seen that the punch 12 is returned to its outermost position. As it is returned to this position it withdraws the case from the bore 8. After leaving this bore the end of the case 21 abuts against the sleeve 17 so that, during the continued movement of the punch 11, the latter is withdrawn from the case. In the event of the case not being withdrawn from the bore 8 by the punch 11, the counter-punch 18 is moved to the position of Figure 7 so as to eject the case 21, this movement taking place after the punch 11 has reached the position of Figure 7.

In the arrangement shown in the accompanying drawings and described above, the extrusion of the metal is effected by the action of the punch 11 being moved relatively to the stationary assembly constituted by the counter-punch 18 and the die 6. It will be appreciated, however, that the same result can be obtained by an analogous arrangement in which a member similar to the counter-punch 18 is moved relatively to a stationary assembly constituted by members similar to the punch 11 and the die 6. In fact, the same results can be obtained in any arrangement in which there is an analogous resultant relative movement between the three elements.

It will be clear that the die need not necessarily be heated by means of an electrical resistance, but that other heating systems may be used, such as those employing gas burners, hot circulating gases, and so forth. The work can be heated prior to insertion into the die, in which case no delay prior to the mechanical working of the metal is necessary.

Figure 8 shows an arrangement in which the form of the base of the case shown in Figure 2 can be modified so that the case takes the form shown in Figure 3. The arrangement of Figure 8 is analogous to that of Figures 5 to 7, the only difference being in the shapes of the ends of the punch and counter-punch. The heated die 23 is identical to the die 6.

Figure 8 shows the punch 24 and counter-punch 25 in their innermost positions, the base of the case exactly filling the space left between their ends. It will be seen that a small

projection 26 on the counter-punch 25 forms a cavity 2 for a percussion cap, while the inner face 4 of the base of the case is flat and merges gently into the tubular wall.

The cartridge case is caused to take its final form shown in Figure 4 by one or more drawing operations in which the cross section of the tubular wall 3 is caused to become tapered.

What I claim and desire to secure by Letters Patent of the United States is:

1. The method of forming a metallic case from a solid piece of metal by reverse extrusion, said method comprising in combination, the steps of placing said piece of metal in contact with a heated body to heat said piece until it becomes plastic, and then subjecting the middle portion of the heated piece of metal to pressure to cause the edge portions thereof to flow in a direction opposite to that of said pressure and to form a tubular member, such as a cartridge case, and then removing said tubular member from contact with said body while the latter is heated.

2. A device for forming a metallic case from a solid piece of metal by reverse extrusion, said device comprising, in combination, a heat transmitting die having a cylindrical bore formed therein, heating means surrounding said die, whereby a piece of metal inserted into said bore is heated until it becomes plastic, a counter-punch movable within said bore and serving as an abutment for the piece of metal, another die situated at a distance from the first mentioned die, and a punch having a conical head, an adjacent cylindrical portion having a diameter which is somewhat smaller than the largest diameter of said conical head, and a shoulder portion adapted to engage the second-mentioned die, said punch being carried by the second-mentioned die and being movable within said bore to press axially against said piece of metal and cause a portion of the heated metal to flow around the walls of the punch and into the space between the two dies to form a tubular member, such as a cartridge case.

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