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⑦ Applicant: **Salmistraro, Remo**
Via Caviglia, 59
I-17024 Finale Ligure Savona(IT)

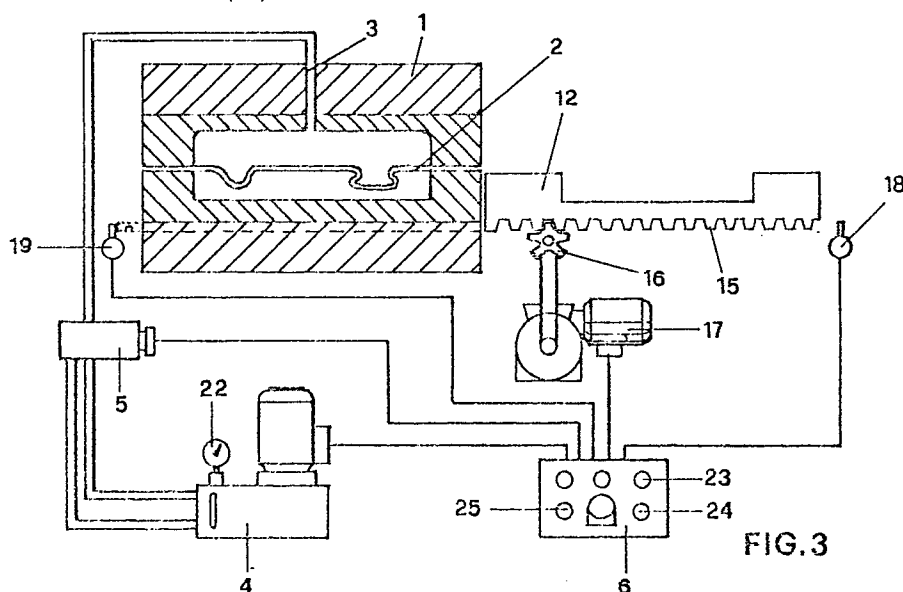
Applicant: **Salmistraro, Mauro**
Via Istria, 37
I-36023 Longare Vicenza(IT)

⑦ Inventor: **Salmistraro, Remo**
Via Caviglia, 59
I-17024 Finale Ligure (Savone)(IT)

⑦ Representative: **Piovesana, Paolo**
Corso del Popolo, 70
I-30172 Venezia-Mestre(IT)

⑤ Method for producing pressed articles from metal foil and press for implementing the method.

⑤ A method for producing pressed articles of metal foil, characterised by constructing a die (14) reproducing the shape of the article to be formed, positioning the foil (21) to be pressed on the die (14) and exerting a pressure on said foil by means of a deformable membrane (7,10) subjected to the action of a fluid mass, in such a manner as to cause it to adhere to the surface of the die (14).



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This invention relates to a method for producing pressed articles from metal foil, and a press for implementing the method.

In various technical sectors, and in particular in goldsmith work, it is known to produce articles by pressing a metal foil. The method comprises the use of a metal punch and die which carry the positive and negative impressions of the object to be formed. In use, the punch and die are fitted to a conventional hydraulic or mechanical press which shapes in accordance with their pattern a metal foil which has been previously cut to size and interposed between them.

This known method, which is still widely used in the jewellery industry, has however certain drawbacks, and in particular:

- it requires the use of a punch and die, the construction of which is very complicated and costly, and is justified only for large-scale production,
- it does not enable undercuts to be made, and
- it is very difficult to make the punch mate with the die.

It is also known to produce pressed articles using only a punch (positive or negative) and replacing the die with a hard rubber pad. In practice this pad acts as the missing die, and on being pressed its yieldability causes it to assume the shape of the punch.

This system has effectively resulted in a series of advantages over the previous system, in that it has practically halved the cost of the die system and has at the same time overcome the difficulty of mating the punch with the die.

However it has not definitively solved the problem as it has not eliminated other drawbacks, namely:

- the need to still construct a metal punch, with its considerable cost amortization problems, which only large-scale production can overcome, and
- the need to operate with only one punch at a time or at the most two punches which are substantially alike in terms of height and volume, to prevent unwanted production non-uniformity because of the integral structure of the rubber pad.

A further drawback of these two described methods when operating on gold is that they can only be used on annealed metal foils, but even so the rapidity of the deformation which this type of pressing involves still leads to their work-hardening. Thus if a fairly large deformation is required, and which in known manner has to be done in two stages, the rapidity of the deformation produces such a work-hardening of the foil that it has to be annealed after the first stage, because the rapidity of the deformation results in a degree of hardening which would not enable it to undergo the second stage.

All these drawbacks are obviated according to

the invention by a method for producing pressed articles of metal foil, characterised by constructing a die reproducing the form of the object to be pressed, positioning the foil to be pressed on the die and exerting a pressure on said foil by means of a deformable membrane subjected to the action of a fluid mass, in such a manner as to cause it to adhere to the die surface.

To implement this method the invention uses a press comprising:

- a chamber formed within a block and housing a fluid mass, and communicating with a central hydraulic unit,
- a deformable membrane at least partly delimiting a wall of said chamber, and
- at least one die which can face said membrane within said block.

A preferred embodiment of the present invention is described hereinafter with reference to the accompanying drawings, in which:

Figure 1 is a longitudinal section through the press of the invention taken on the line I-I of Figure 2;

Figure 2 is a partial cross-section therethrough on the line II-II of Figure 1;

Figure 3 is a operational diagram of a plant using the press according to the invention; and

Figure 4 is a diagrammatic perspective view of a die holder plate.

As can be seen from Figure 1, the press according to the invention comprises a robust structure formed from a block 1 of hardened steel, in which there is formed a chamber 3 communicating with a central hydraulic unit by way of a conduit 3. A conventional three-way solenoid valve 5 connected to a central electrical control unit 6 either connects the hydraulic unit 4 to the press chamber 2 or connects the delivery and return lines of the hydraulic unit together.

The chamber 2 is closed lowerly by a yieldable membrane 7 constructed preferably of urethane elastomer such as the type known commercially as "VULCALAN". It is retained at its edge by a metal plate 8 with rounded edges, which is fixed to the structure 1 by screws 9.

External to the membrane 7 there is provided a further membrane 10 also of urethane elastomer construction and retained in place by a perimetral section 11.

In a position underneath the membrane 10 there is provided in the block 1 a longitudinal channel in which there can slide horizontally a tray 12 which holds a die holder plate 13. More specifically, the tray 12 is formed from a thick metal plate with raised edges which define a seat for the die holder plate 13.

This is provided with a plurality of seats (circular in the illustrated example), into which the

desired number of dies 14 can be inserted. Each die, which reproduces preferably in negative form the impression of the object to be pressed, is constructed of steel-filled resin and is produced by simple conventional preparation methods at extremely low cost.

The tray 12 is provided lowerly with a rack 15 engaging with a pinion 16 rotated by a geared motor unit 17. This geared motor unit is connected to the electrical control unit 6 to be driven in synchronism with the other operating stages.

The longitudinal channel for guiding the tray 12 within the block 1 extends outside the block so that the tray can be moved from a position totally contained within the block 1 to a position totally outside it. These two end positions are defined by two limit switches 18 and 19 which are also connected to the electrical control unit 6.

The operation of the press according to the invention is as follows:

when under rest conditions the hydraulic unit 4 and the geared motor unit 17 are at rest and the tray 12 is in the position extracted from the block 1 and has its edge in contact with the limit switch 18.

In this position the operator can insert into the tray the die holder plate 13 provided with the particular seats for the dies 14 which he requires to use, and into which he has inserted the necessary dies which have been previously constructed separately by conventional methods.

Having carried out this procedure, during which any seats unoccupied by dies must be filled with "blind" dies, ie without impressions, a foil 21 previously cut to size must be positioned on each die 14.

The thickness of the die plate 13 should preferably be less than the height of the front edges of the tray 12 so that after applying the foil to be pressed, the die holder plate can be covered with a further yieldable protection blanket 20 of such a thickness as not to exceed the height of said front edges.

When this preparatory work is complete, the automatic forming cycle is controlled by the electrical control unit. The geared motor unit 17 is firstly operated to transfer the tray 12 into the block 1 until it reaches the position defined by the limit switch 19. Here, the signal transmitted by the limit switch 19 to the electrical control unit 6 results in a command to the hydraulic unit 4 and opens the solenoid valve 5 which allows oil to flow through the conduit 3 and into the chamber 2 of the block 1.

The pressure of the oil which flows into the chamber 2 exerts a very strong thrust on the membrane 7, on the membrane 10 and on the blanket 20, which penetrates into the cavities of the dies 14 to cause the interposed foil 21 to adhere to the

shaped surfaces of these latter. After a predetermined working time, an automatic command halts the unit 4, allows the oil to return to it and allows the two membranes 7 and 10 and the blanket 20 to return to their initial configuration, but leaves the foil 21 permanently deformed to correspond to the impression in the relative die 14. When the tray 12 has totally emerged from the block 1 and touches the limit switch 18, the cycle stops to allow the operator to extract the shaped foils and to replace them with others to be subjected to the same working cycle.

If necessary, the dies 14 can be replaced in the die holder 13, or the die holder 13 itself replaced if the new dies are of different outer dimensions.

Both the hydraulic unit 4 and the electrical control units 6 are provided with all the instruments and controls required for complete adaptation to the particular work to be done. In particular, the hydraulic unit 4 can be provided with pressure control in order to adapt the pressure to foils of different thickness, a pressure gauge 22 for checking that the pressure is correct, and a manual control for operating the solenoid valve 5.

The electrical control unit 6 can be provided with a series of indicator lamps 23 for the various stages of the operating cycle, a pair of timers 24 and 25 for controlling respectively the pressing time as a function of the oil pressure and the extent of the membrane deformation, and the time for emptying the chamber 2, ie the time after which the geared motor unit 17 can be reoperated on termination of the pressing cycle, to extract the tray 12.

From the foregoing it is apparent that the method according to the invention and the press for implementing it represent substantial progress over the known art of this sector by offering numerous advantages, and in particular:

- they enable resin dies to be used, these being quick and inexpensive to construct; consequently large-scale production is not necessary for amortizing equipment costs,
- they require no special setting of the die positions,
- they allow deep pressings, and including undercuts,
- they deform the metal foil slowly and softly, without inducing any work-hardening of the material,
- they enable dies of even considerably different characteristics to be used in the same pressing stage.

In a modified embodiment, not shown on the drawings, the tray 12 is of the two-stage type such that when one stage is within the block 1 the other is projecting from it to the right or left. In this

manner, while one series of dies is subjected to the pressing cycle, the other series can be prepared by the operator for the next cycle, so obtaining a considerable overall reduction in working time.

Claims

1. A method for producing pressed articles of metal foil, characterised by constructing a die (14) reproducing the shape of the article to be formed, positioning the foil (21) to be pressed on the die (14) and exerting a pressure on said foil by means of a deformable membrane (7,10) subjected to the action of a fluid mass, in such a manner as to cause it to adhere to the surface of the die (14).

2. A method as claimed in claim 1, characterised by fitting the die (14) into a die holder (13) by means of which said die is caused to face the deformable membrane (7,10,20).

3. A method as claimed in claim 2, characterised by fitting several dies (14) into a die holder (13), positioning on each die (14) a foil (21) to be pressed, and exerting a pressure on all the foils by means of a single deformable membrane (7,10) subjected to the action of the same fluid mass.

4. A method as claimed in claim 1, characterised by interposing between said membrane (7,10) and the foil or foils (21) to be pressed at least one deformable protection blanket (20).

5. A method as claimed in claim 1, characterised by deforming the membrane (7,10) by means of oil.

6. A method as claimed in claim 2, characterised by using two die holders (13) in such a manner that while the die (14) fitted to one of these is subjected to the action of the deformable membrane (7,10), the other die holder (13) is undergoing preparation for the next working cycle.

7. A press for implementing the method claimed in one or more of claims 1 to 6, characterised by comprising:

- a chamber (2) formed within a block (1) and housing a fluid mass and communicating with a central hydraulic unit (4),
- a deformable membrane (7,10) at least partly delimiting a wall of said chamber (2), and
- at least one removable die (14) which can face said membrane (7, 10) within said block (1).

8. A press as claimed in claim 7, characterised by comprising a die holder (13) into which the die (14) can be inserted in order to face said membrane (7,10).

9. A press as claimed in claim 7, characterised in that the chamber (2) is closed by a bored metal plate (8) about which the membrane (7) is wrapped and its edges clamped between said plate and the wall of said chamber (2).

10. A press as claimed in claim 7, characterised in that the deformable membrane (7,10) is constructed of urethane elastomer.

11. A press as claimed in claim 8, characterised in that the die holder is in the form of a metal plate in which seats are provided for housing the dies (14).

12. A press as claimed in claim 11, characterised by comprising a tray (12) insertable into said press and provided with a seat for the die holder (13), said tray being mobile between a position external to the press for allowing preparation the die holder (13), and an internal position in which the die holder (13) faces the deformable membrane.

13. A press claimed in claim 12, characterised in that the support tray (12) for the die holder (13) is associated with means for moving it away from and towards said block (1).

14. A press as claimed in claim 13, characterised by comprising two limit switches (18,19) which are activated by the support tray (12) for the die holder (13) when in its two end positions within and outside said block (1).

15. A press as claimed in claim 7, characterised in that each die (14) is constructed of resin possibly filled with steel.

16. A press as claimed in claim 7, characterised by comprising a deformable protection blanket (20) interposable between the dies (14) and the membrane (7,10) of the chamber (2).

17. A press as claimed in claim 10, characterised in that the tray (12) is provided with two seats for two separate die holders (13) and is mobile alternately between the two end position, in which one of the two die holder (13) faces the deformable membrane (7,10) while the other is outside the block (1) to enable it to be prepared.

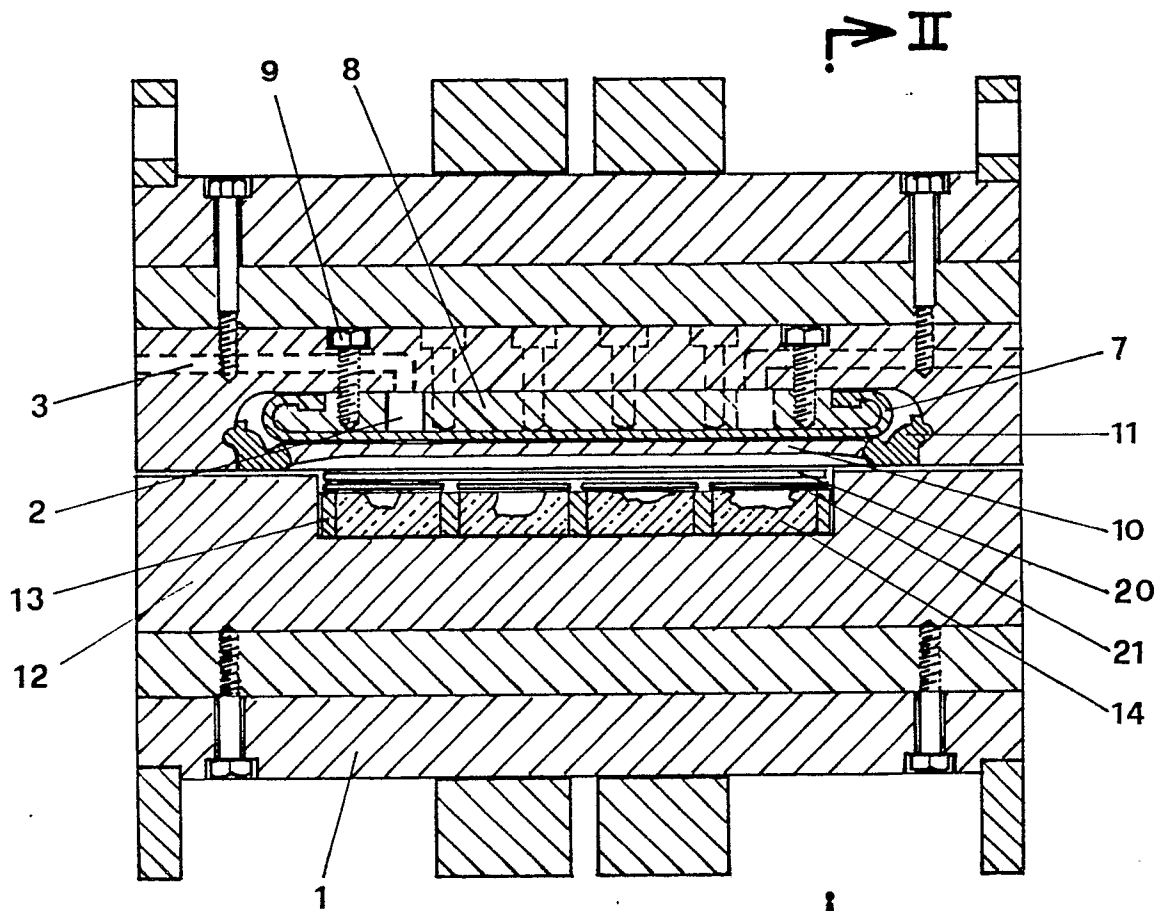


FIG. 1

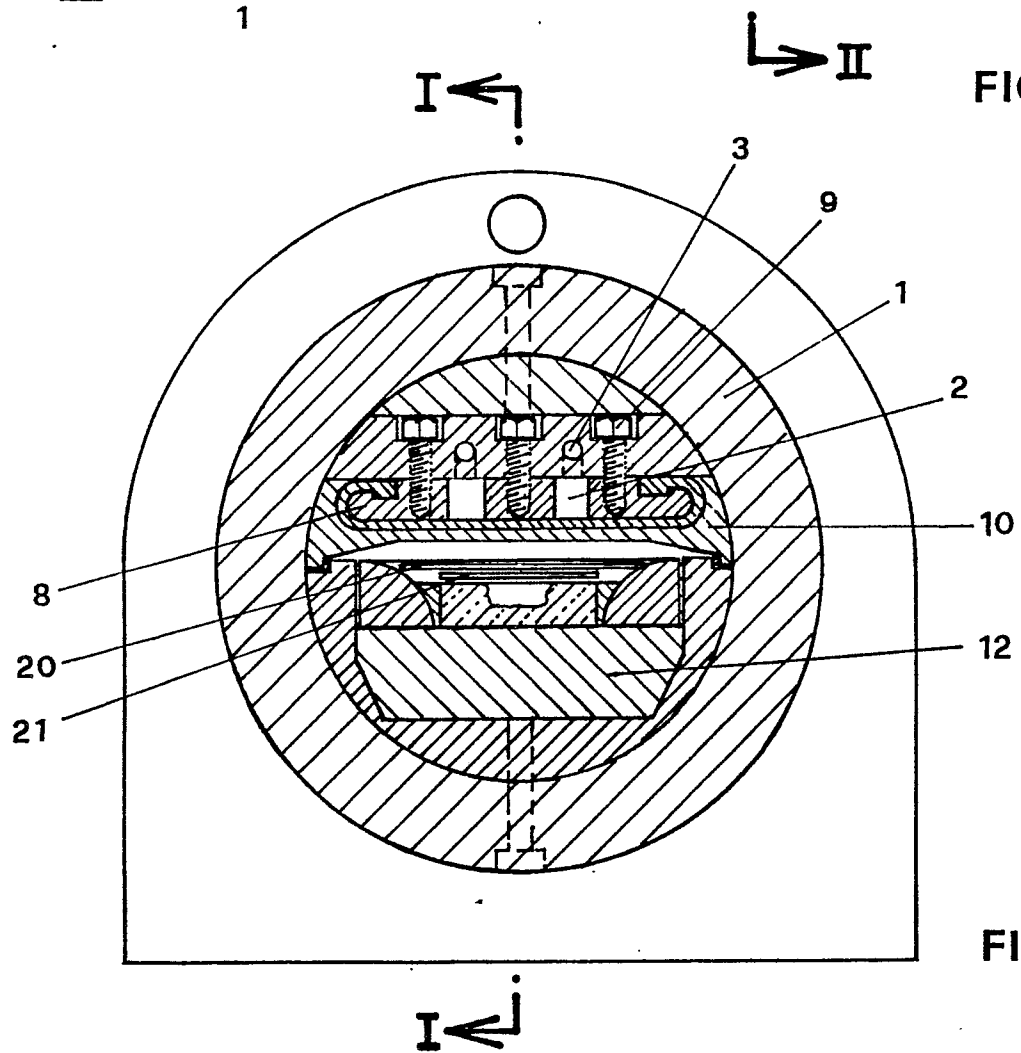


FIG. 2

