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A method of pressing sheet metal and a hydraulic press for carrying out the method.

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Description

The present invention relates to a method of pressing sheet metal, including the steps of providing a press having a punch, a die, and a blank-holder for restraining a metal sheet at an edge region of the die by clamping it between the blank-holder and the edge region.

The present invention also relates to a hydraulic press for pressing sheet metal, of the type including at least one blank-holder operated by actuators through an hydraulic operating circuit.

In known pressing methods, the optimum clamping pressure for the blank-holder is determined empirically and, during normal production, is kept constant throughout the pressing period. With this constant-pressure method, difficulties are encountered with complex dies and deep drawing. Moreover, the characteristics of the metal sheets and their pre-treatment (for example, with lubricants) represent variables which may mean that the clamping pressure, which is determined empirically beforehand, is not at an optimum.

In order to resolve the aforementioned problems, particular attention is currently being paid to the design and construction of the dies with the use of mathematical models to predict the limits of the drawing capability of a given geometry, but not always with satisfactory results.

DE-A-3744177 discloses a method of pressing sheet metal in which the force having effect on the blank-holder is electronically controlled according to a predetermined law. The control system used in such known process needs a central process unit and a sensor of the punch's travel in order to make the pressure acting on the blank-holder dependent from the position of the punch.

The object of the present invention is to provide a pressing method of the type specified at the beginning of the description which does not have the aforementioned disadvantages and which is simple and cheap to put into practice.

According to the invention, this object is achieved by virtue of the fact that the blank-holder is clamped onto the metal sheet with a force which can be alternated cyclically and repeatedly between minimum and maximum values during the deforming of a metal sheet. The repeated alternation of the pressure of the blank-holder between a maximum value and a minimum value at a suitable frequency enables the metal sheet to adapt itself to the requirements of deformation during the pressing regardless of the nature of the metal sheet and its surface treatment. Moreover, with the method according to the invention, the step of adjusting the clamping pressure is eliminated and the drawing depth can be increased.

Further advantages of the method relate to the reduction of the amount of sheet metal affected by the

blank-holder, the reduction of the number of rejects, the elimination of the need to use conventional pressing lubricants, the fact that any kind of coating can be used on the metal sheet, and the reduction of the pitting of the pressed pieces.

The method according to the invention can be carried out on a hydraulic press for pressing sheet metal, of the type including at least one blank-holder operated by actuators through an hydraulic operating circuit, in which the hydraulic circuit includes valve means for alternately depressurising/pressurising the actuators of the blank-holder to cause the clamping pressure of the blank-holder to vary repeatedly according to a predetermined law.

Further advantages and characteristics of the method and the press according to the invention will become clear from the following detailed description, provided purely by way of non-limiting example, with reference to the appended drawings, in which:

Figure 1 is a schematic view which shows the operation of a press according to the invention,

Figure 2 is a schematic view similar to Figure 1 and shows a second embodiment of a press according to the invention, and

Figure 3 is a schematic perspective view of the press of Figure 1.

With reference to the first embodiment illustrated in Figures 1 and 3, a hydraulic press, indicated 10, includes a die 12, a punch 14 and a blank-holder 16. A flat metal sheet L is interposed between the blank-holder and the die 12 for drawing. Compared with known presses, the press 10 has a special hydraulic circuit 18 for operating actuators 20 associated with the blank-holder 16. In fact, the hydraulic circuit 18 includes a valve unit 22 for cutting off the flow supplied by a pump p for very short periods at a frequency which is variable in dependence on the type of die but is preferably between 20 and 30 Hz. The valve unit 22 is not discussed in detail herein since it is of substantially the same type as is used, for example, in anti-lock braking systems for automatically pressurising/depressurising the hydraulic circuit associated with the brakes.

The pressure for operating the blank-holder 16 is applied and released within a range defined by a maximum value and a minimum value, or within a suitable interval between these values. To advantage, the valve means 22 may be associated with an electronic control system for modulating the pressurisation/depressurisation frequency in dependence on the various geometries of the dies, acting separately on the actuators 20 of the blank-holder 16. In this case, the optimum pressure interval and the individual control of the actuators 20 will be determined in dependence on the various geometries of the dies.

Figure 2 shows a second embodiment of the invention which uses a die 25 with two superposed cavities 25a acted on by two opposed punches 14. In this

embodiment, the operation of the two blank-holders 16 is essentially identical to that described for Figures 1 and 3.

Claims

1. A method of pressing sheet metal, including the steps of providing a press (10) having a punch (14), a die (12) and a blank-holder (16) for restraining a metal sheet (L) at an edge region of the die (12) by clamping it between the blank-holder (16) and the edge region, characterised in that the blank-holder (16) is clamped onto the metal sheet (L) with a force which is alternated cyclically and repeatedly between minimum and maximum values during the deforming of a metal sheet (L) at a suitable frequency, preferably between 20 and 30 Hz, in order to enable the metal sheet (L) to adapt itself to the requirements of the deformation.
2. An hydraulic press for pressing sheet metal, of the type including at least one blank-holder (16) operated by the actuators (20) through an hydraulic operating circuit (18) characterised in that the hydraulic circuit (18) includes valve means (22) for alternatively depressurising / pressurising the actuators (20) of the blank-holder (16) in order to alternate cyclically and repeatedly the clamping pressure of the blank-holder (16) between minimum and maximum values during the deforming of a metal sheet (L), at a suitable frequency, preferably between 20 and 30 Hz, in order to enable the metal sheet (L) to adapt itself to the requirements of the deformation.
3. An hydraulic press according to claim 2, characterised in that the valve means (22) are adapted to alternate the operating pressure of each actuator (20) of the blank-holder (16) according to a different law from that of any other actuator (20).

Patentansprüche

1. Verfahren zum Umformen von Blech, umfassend die Schritte des Bereitstellens einer Presse (10) mit einem Stempel (14), einer Form (12) und eines Formling-Halters (16) zum Festhalten eines Blechs (L) an einem Randbereich der Form (12) durch Klemmen desselben zwischen den Formling-Halter (16) und den Randbereich, **dadurch gekennzeichnet**, daß der Formling-Halter (16) auf das Blech (L) mit einer Kraft geklemmt wird, welche während der Verformung eines Blechs (L) mit einer geeigneten Frequenz, vorzugsweise 20 bis 30 Hz, zy-

klisch und in sich wiederholender Weise zwischen Minimal- und Maximalwerten alterniert wird, um zu ermöglichen, daß sich das Blech (L) den Verformungserfordernissen anpaßt.

2. Hydraulische Presse zum Umformen von Blech, welche dem Typ angehört, der wenigstens einen von den Aktuatoren (20) durch einen hydraulischen Betätigungskreis (18) betätigten Formling-Halter (16) umfaßt, **dadurch gekennzeichnet**, daß der hydraulische Kreis (18) Ventilmittel (22) zum alternativen Druckverringern/Druckerhöhen der Aktuatoren (20) des Formling-Halters (16) umfaßt, um den Klemmdruck des Formling-Halters (16) während der Verformung eines Blechs (L) mit einer geeigneten Frequenz, vorzugsweise 20 bis 30 Hz, zwischen Minimal- und Maximalwerten zyklisch und in sich wiederholender Weise zu alternieren, um zu ermöglichen, daß sich das Blech (L) den Verformungserfordernissen anpaßt.
3. Hydraulische Presse nach Anspruch 2, **dadurch gekennzeichnet**, daß die Ventilmittel (22) dazu ausgebildet sind, den Betätigungsdruck jedes Aktuators (20) des Formling-Halters (16) gemäß einer Gesetzmäßigkeit zu alternieren, welche sich von der jedes anderen Aktuators (20) unterscheidet.

Revendications

1. Procédé d'emboutissage d'une feuille métallique, comprenant les étapes suivantes : la disposition d'une presse (10) ayant un poinçon (14), une matrice (12) et un porte-flan (16) destiné à retenir une feuille métallique (L) dans une région de bord de la matrice (12) par serrage entre le porte-flan (16) et la région de bord, caractérisé en ce que le porte-flan (16) est serré sur la feuille métallique (L) avec une force qui alterne cycliquement et de manière répétée entre les valeurs minimale et maximale pendant la déformation d'une feuille métallique (L) à une fréquence convenable, de préférence comprise entre 20 et 30 Hz, de manière que la feuille métallique (L) puisse s'adapter elle-même aux conditions de déformation.
2. Presse hydraulique d'emboutissage d'une feuille métallique, du type qui comprend au moins un porte-flan (16) commandé par des organes de manoeuvre (20) par l'intermédiaire d'un circuit hydraulique de commande (18), caractérisée en ce que le circuit hydraulique (18) comporte un dispositif à soupape (22) destiné à mettre en alternance sous pression et hors pression les organes de manoeuvre (20) du porte-flan (16) afin

que la pression de serrage du porte-flan (16) alterne cycliquement et de manière répétée entre les valeurs minimale et maximale pendant la déformation d'une feuille métallique (L), à une fréquence convenable, de préférence comprise entre 20 et 30 Hz, afin que la feuille métallique (L) puisse s'adapter d'elle-même aux conditions de la déformation.

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3. Presse hydraulique selon la revendication 2, caractérisée en ce que le dispositif à soupape (22) est destiné à faire alterner la pression de commande agissant sur chaque organe de manoeuvre (20) du porte-flan (16) d'après une loi différente de celle d'un autre organe de manoeuvre (20).

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FIG. 1

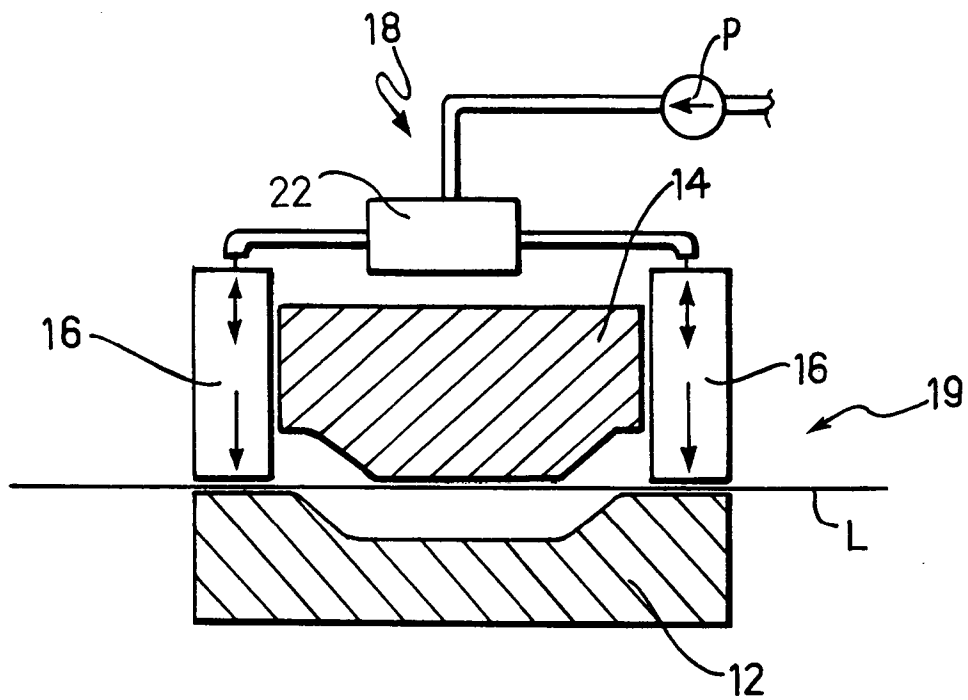


FIG. 2

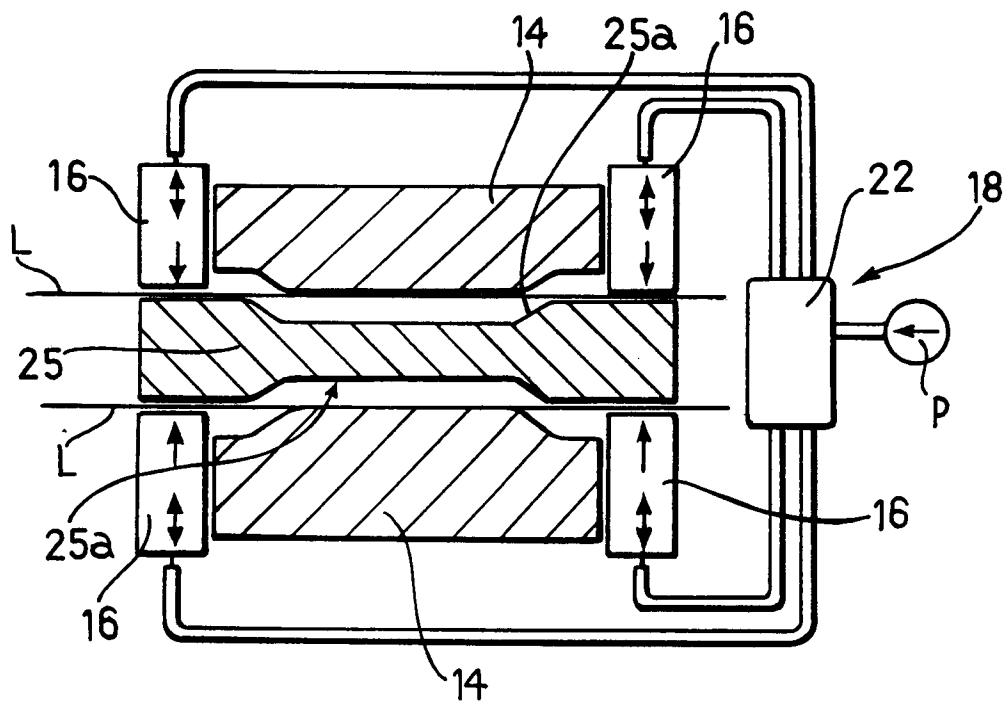


FIG. 3

