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(54) **A bending machine, in particular for sheet steel**

Biegemaschine, insbesondere zum Biegen von Stahlblechen

Machine à cintrer, notamment pour le cintrage de tôles en acier

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- **PATENT ABSTRACTS OF JAPAN vol. 008, no. 096 (M-294), 4 May 1984 (1984-05-04) & JP 59 010419 A (KAWASAKI STEEL CORP), 19 January 1984 (1984-01-19)**

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Description

[0001] The invention relates to a bending machine as described in the preamble to the first claim.

[0002] Specifically, though not exclusively, the invention is usefully applied for varying the longitudinal axis of a workpiece, for example sheet steel, by plastic deformation, to a predetermined angle and with the resultant fold having a relatively small curvature.

[0003] A machine of this type already exists in the prior art, which plastically deforms the sheet steel to a dihedral axis and with a relatively small curvature in the angle in relation to the steel thickness. The bottom die is usually in the shape of a V-cavity, and the sheet of steel is placed on the edges of the die before the punch is brought into action, thrusting into the centre of the sheet until the latter adheres perfectly to the walls of the bottom die.

[0004] ***US-3209576 , on which the preamble of claim 1 is based, discloses a bending machine comprising a bottom die which describes al least one dihedral bending angle, and a punch predisposed for pressing a workpiece to be bent agains the bottom die, in which the bottom die comprises idle means predisposed to interact contactingliy with the workpiece during a pressing action of the punch.***

[0005] Machines of this type, however, exhibit some drawbacks.

[0006] Firstly, they require forces of considerable size to bend the steel, with a consequently high energy consumption.

[0007] Secondly, during the bending operation a high level of friction is created between the steel and the edges of the die, which can damage the sheet steel, leading to risks of scratching the steel surface and scoring in the part of the steel inside the die

[0008] The main aim of the present invention is to provide a machine which can overcome the above-described prior-art drawbacks and limitations.

[0009] An advantage of the invention is that it is constructionally simple and economical.

[0010] A further advantage is that the invention provides a machine which has a relatively low energy consumption.

[0011] A further advantage is that friction on the steel is reduced during the bending operation.

[0012] Further advantages are: especially delicate objects can be bent with no risk of damage; dragging of the material against the die during bending is reduced to a minimum, as is the risk of scratching; bend angle precision is improved; the perpendicularity of the punch is guaranteed with respect to the die during punch operation.

[0013] These aims and advantages and more besides are all attained by the present invention by a bending machine according to claim 1.

[0014] Further characteristics and advantages of the invention will better emerge from the detailed description that follows of a preferred embodiment of the invention, illustrated purely by way of an example in the accompanying figures of the drawings, in which:

figure 1 is a schematic view in vertical elevation of a detail of the machine;
figure 2 is the view of figure 1 in a different operational configuration.

[0015] With reference to the figures of the drawings, 1 denotes the punch of a bending machine for plastically deforming metal objects, in particular sheet steel, by means of bending against a bottom die. The punch 1 is operatively associated with a press, of known type and not illustrated, exerting a pressing action in the direction of a vertical axis x-x. The punch 1 exhibits a lower end 2, destined to contact the workpiece object to be bent; the punch lower end 2 has a rounded striker with an angle of curvature which roughly corresponds to the desired angle of curvature in the object after bending.

[0016] The bending machine comprises a bottom die 3, which identifies at least one dihedral bending angle, against which the punch 1 presses a workpiece 4. The bottom die 3 is suitable for bending the workpiece 4 at the bottom end of the die 3, where the workpiece is pressed against the wall at the bottom of the die 3 and thus takes on the dihedral bending angle of the wall itself.

[0017] The die 3 comprises idle means for interacting on contact with the workpiece 4 during the punch 1 pressing action. In the illustrated embodiment the idle means comprise four idle wheels 5, rotatably mounted on two opposite-facing skates 6, themselves rotatable about pivots 7 with parallel oscillation axes. The skates 6, which are rotatably coupled to a fixed frame 8, are situated on opposite sides of the axis x-x of the punch 1, and are symmetrically arranged with respect to a vertical plane passing through the axis x-x and parallel to the oscillation axes of the skates 6. Each skate 6 bears, on opposite sides with respect to the axis of oscillation thereof, two idle wheels 5. The axis of rotation of each wheel 5 is parallel to the axes of oscillation of the skates 6. The wheels 5 project from the skates 6 which support the wheels 5, so that the workpiece 4 can run on the wheels 5 during the bending stage.

[0018] The bottom die 3 exhibits a mobile bottom wall, with variable and adjustable geometry. The bottom wall is described by the idle wheels 5 of the skates 6, and can assume at least two positions. The first of these positions (see figure 1) is a starting position in which the idle wheels 5 together form a rest plane, preferably horizontal and perpendicular to the axis x-x in which the punch operates. The workpiece 4 is positioned against the rest plane when in this position. In the second of the positions (see figure 2), the idle wheels 5 describe a dihedral angle into which the workpiece 4 has been pressed and plastically deformed. In the first position each skate 6 interacts contactingly with a stop 9 solidly fixed to the frame 8.

[0019] During operation the punch 1 is commanded by the press to descend towards the object 4 positioned on

the bottom die 3, which latter is in the horizontal first position. When the punch 1 meets the upper side of the workpiece 4 the bending action begins, during which the lower side of the workpiece 4 interacts contactingly with the idle wheels 5 of the die 3. Thanks to the sliding rest afforded by the wheels 5, the parts of the object 4 in contact with the die 3, during the bending process, run against the die 3 with no dragging, and with very low friction. The friction generated is almost exclusively of the revolving type, with a practically total elimination of dragging friction.

[0020] By virtue of this sliding-by-rolling effect, with no dragging means that the pressing force needed to bend the workpiece 4 is considerably reduced, as is the risk of localized crumpling or stretching on the workpiece 4 after the bending, as well as the risk of superficial damage (scratching, scoring and so on) on the bent workpiece 4.

[0021] It has been seen that using the bending machine of the invention considerable bend-angle precision can be achieved.

[0022] The machine is especially usable for bending sheet steel, but is advantageously applicable also in bending other plastically-deformable objects, of various shapes.

Claims

1. A bending machine, comprising a bottom die (3) which describes at least one dihedral bending angle, and a punch (1) predisposed for pressing a workpiece (4) to be bent against the bottom die (3), , said bottom die (3) comprising idle means (5,6) comprising wheels (5) **characterised in that** the bottom die (3) exhibits a mobile bottom wall, with variable and adjustable geometry whereby said idle means (5, 6) is predisposed to interact contactingly with the workpiece (4) during a pressing action of the punch (1), said bottom die (3) also comprising at least two skates (6) ***which skates (6) are rotatable about pivots 7 and have parallel oscillation axes and each bear,*** on opposite sides of an axis of oscillation of the skate (6), two idle wheels (5)said bottom wall, which is described by the idle wheels (5) of the skates (6), being able to assume at least two positions: a first position in which the idle wheels (5) together form a rest plane perpendicular to the axis x-x in which the punch operates and the workpiece (4) is positioned against the rest plane, and a second position in which the idle wheels (5) describe a dihedral angle into which the workpiece (4) has been pressed and plastically deformed.

2. The machine of claim 1 **characterised in that** the at least two skates (6) are situated on either side of an axis of action (x-x) of the punch (1).

3. The machine of claim 1**characterised in that** it comprises at least a stop (9) with which each skate (6) interacts contactingly in said first position.

Patentansprüche

1. Biegemaschine, enthaltend eine untere Matrize (3), welche wenigstens einen zweiflächigen Biegewinkel beschreibt, und einen Stempel (1), vorgesehen zum Pressen eines zu biegenden Werkstückes (4) gegen die untere Matrize (3), wobei die genannte untere Matrize (3) leerlaufende Mittel (5, 6) mit Rollen (5) enthält, **dadurch gekennzeichnet, dass** die untere Matrize (3) eine bewegliche untere Wand von veränderbarer und einstellbarer Geometrie aufweist, wobei die genannten leerlaufenden Mittel (5, 6) dazu vorgesehen sind, während eines Pressvorgangs des Stempels (1) im Kontakt mit dem Werkstück (4) zusammenzuwirken, wobei die genannte untere Matrize (3) ebenfalls wenigstens zwei Schwingelemente (6) enthält, welche Schwingelemente (6) um Zapfen (7) drehbar sind und parallel verlaufende Schwingachsen haben, und wobei jedes auf entgegengesetzten Seiten einer Schwingachse des Schwingelementes (6) zwei leerlaufende Rollen (5) trägt; wobei die genannte untere Wand, welche durch die leerlaufenden Rollen (5) der Schwingelemente (6) beschrieben wird, in der Lage ist, wenigstens zwei Positionen einzunehmen: eine erste Position, in welcher die leerlaufenden Rollen (5) zusammen eine Auflagefläche lotrecht zu der Achse x-x bilden, in welcher der Stempel arbeitet und das Werkstück (4) auf der Auflagefläche positioniert ist, und eine zweite Position, in welcher die leerlaufenden Rollen (5) einen zweiflächigen Winkel beschreiben, in welchen das Werkstück (4) gepresst und plastisch verformt werden soll.

2. Maschine nach Patentanspruch 1, **dadurch gekennzeichnet, dass** auf jeder Seite einer Wirkungsachse x-x des Stempels (1) wenigstens zwei Schwingelemente (6) angeordnet sind.

3. Maschine nach Patentanspruch 1, **dadurch gekennzeichnet, dass** sie wenigstens einen Anschlag (9) enthält, mit welchem jedes Schwingelement (6) in der genannten ersten Position im Kontakt zusammenwirkt.

Revendications

1. Machine à cintrer, comprenant une matrice (3) qui décrit au moins un angle dièdre de cintrage, et un poinçon (1) prédisposé pour presser une pièce (4) à cintrer contre la matrice (3), ladite matrice (3) comprenant des moyens libres (5, 6) comprenant des roues (5), **caractérisée en ce que** la matrice (3)

présente une paroi de fond mobile, avec une géométrie variable et réglable de part laquelle lesdits moyens libres (5, 6) sont prédisposés pour interagir en contact avec la pièce (4) pendant une action de pression sur le poinçon (1), ladite matrice (3) comprenant en outre au moins deux patins (6), lesquels patins (6) sont pivotants autour de pivots (7) et présentent des axes d'oscillation parallèles et supportent chacun, sur des côtés opposés d'un axe d'oscillation du patin (6), deux roues folles (5); ladite paroi de fond, qui est formée par les deux roues folles (5) des patins (6), pouvant assumer au moins deux positions: une première position dans laquelle les roues folles (5) forment ensemble un plan perpendiculaire d'appui à l'axe x-x dans lequel le poinçon opère et la pièce (4) est positionnée contre le plan d'appui, et une seconde position dans laquelle les roues folles (5) décrivent un angle dièdre dans lequel la pièce (4) a été pressée et plastiquement déformée.

2. Machine selon la revendication 1, **caractérisée en ce que** les au moins deux patins (6) sont situés de chaque côté d'un axe d'action (x-x) du poinçon (1).

3. Machine selon la revendication 1, **caractérisée en ce qu'**elle comprend au moins une butée (9) dans laquelle chaque patin (6) interagit en contact dans ladite première position.

Fig.1

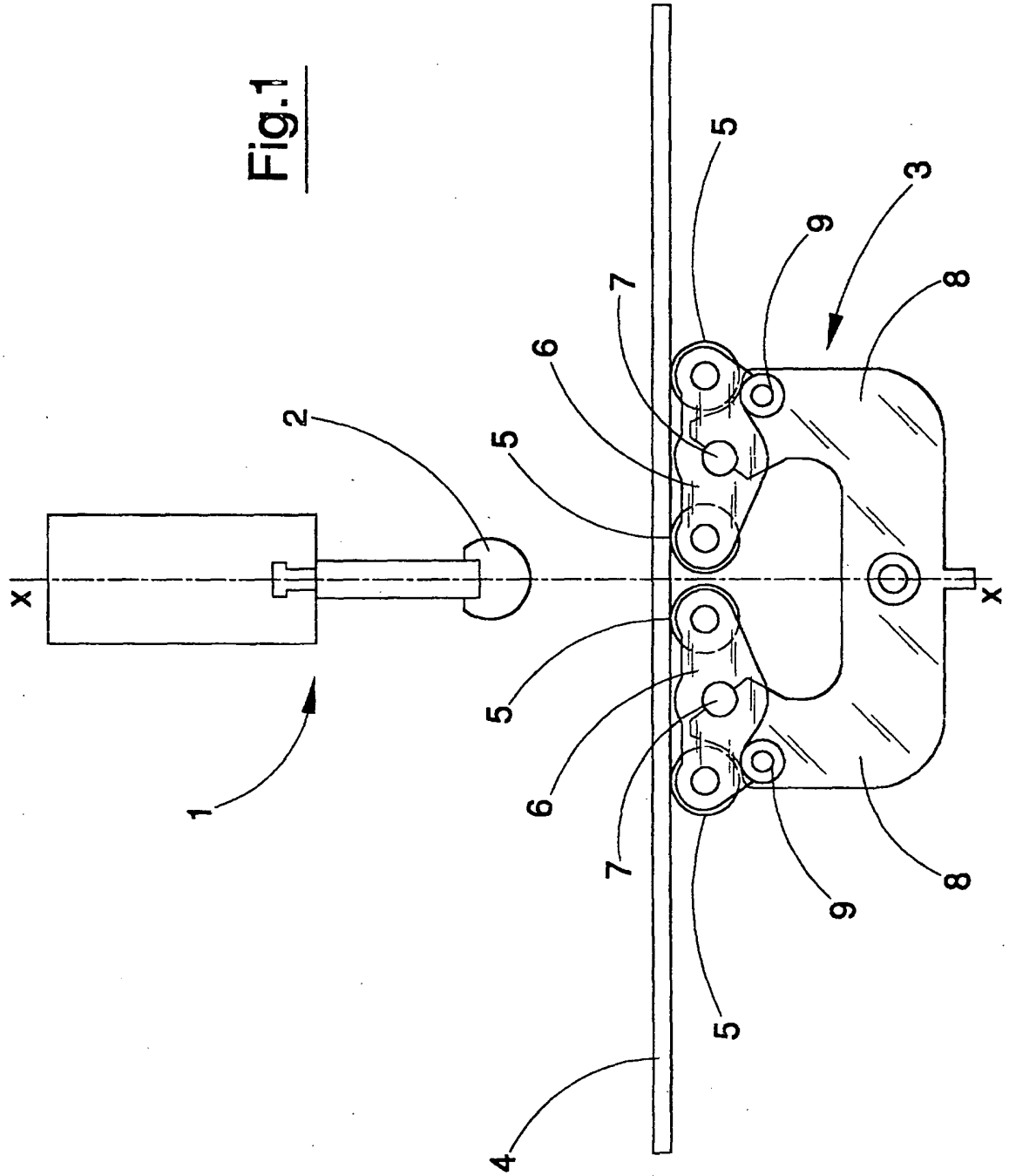

Fig. 2