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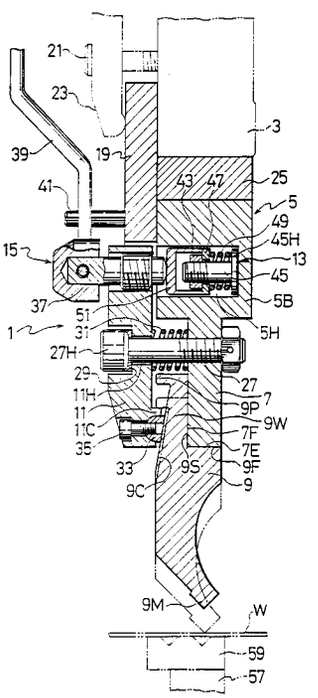
(54) Upper tool for press brake.

(57) The present invention relates to an upper tool for a press brake comprising a shank to be clamped to a support body mounted on an upper table by a clamping force of a pressing-down and fixing member. The upper tool is improved in that the shank is formed with an inclined surface for gradually increasing the clamping force of the pressing-down and fixing member to said upper tool by relative movement of said upper tool to the support body.

FIG. 2



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The present invention relates to an upper tool for a press brake, comprising a shank to be clamped to a support body mounted on an upper table by a clamping force of a pressing-down and fixing member.

As is well known, a press brake is provided with an upper table (referred to as an upper apron, sometimes) and a lover table (referred to as a lower apron, sometimes) arranged in such a way as to be opposed to each other, and either of the upper or lower cable is disposed movably in the vertical direction.

To bend a plate like workpiece for instance, an upper tool is mounted on the lower part of the upper table, and a lower tool is mounted on the upper part of the lower table. Therefore, when the movable side table is moved up and down so that the upper and lover tools can be engaged with each other, a workpiece positioned between the upper and lower tools is to be bent.

Further, in the above-mentioned press brake, a number of upper tool holders are mounted on the lower part of the upper table to exchange the upper tool with an appropriate one according to the bending shape of the workpiece, In other words, the upper tools are supported by a number of upper holders so as to be exchanged.

In the prior art upper tool holder, the structure is such that in upper-tool pressing-down and fixing member is mounted on a holder body attached to the lower part of the upper table, and the upper-tool pressing-down and fixing member is fastened with fastening bolts to tightly fasten and fix the upper part of the upper tool between the holder body and the upper tool clamp.

Therefore, when the upper tool is required to be exchanged with another one, since a number of fastening bolts provided for a number of upper tool holders must be loosened, there exists a problem in that the exchanging work of the upper tool is extremely complicated and therefore troublesome.

To overcome the above-mentioned problem, a structure such that air cylinders are mounted on the upper tool holders to fasten and loosen the upper-tool pressing-down and fixing members has been developed.

In the above-mentioned structure, however, since an air cylinder must be provided for each of a number of the upper tool holders and additionally an air source is required, there raises another problem in that the structure is further complicated and therefore costly.

Further, in the prior art structure, there exists such a danger that when the pressing-down and fixing of the upper tool by means of the upper-tool pressing-down and fixing member is loosened, the upper tool drops. Further, when the upper tool is mounted on the upper tool holder, the upper-tool pressing-down and fixing member must be fastened tightly under the conditions that the upper-cool pressing-down and fixing member is fastened slightly to such an extent that the upper tool will not drop and thereafter the upper and lower tools are aligned with respect to each other, thus causing a problem in that the upper tool exchanging work is troublesome.

With these problems in mind, therefore, it is an objective of the present invention to provide an improved upper tool for a press brake, which can be easily and quickly exchanged in an upper tool holder.

According to the present invention, the aforementioned objective is performed in that said shank is formed with an inclined surface for gradually increasing the clamping force of the pressing-down and fixing member to said upper tool by relative movement of said upper tool to the support body.

Preferred embodiments of the invention are laid down in the subclaims.

Hereinafter, the present invention is illustrated and explained in greater detail by means of a preferred embodiment thereof and accompanying drawings, wherein:

Fig. 1 is a front view showing an upper tool according to an embodiment of the present invention, the upper tool being clamped to a holding device;

Fig. 2 is a cross-sectional view taken along the lines 200-200 shown in figure 1.

An upper tool according to a preferred embodiment of the present invention is generally indicated by the reference numeral 9.

As shown in Fig. 2, the upper tool 9 exchangeably mounted on the upper holding device 1 as described later on, is formed with a wedge portion 9W having a contact surface 9F brought into contact with a lower end surface 7E of a support plate 7, a sliding surface 9S brought into slidable contact with a front surface 7F of the support plate 7, and a clamp surface 9C brought into tight contact with a push member 33 of an upper-tool pressing-down and fixing member 11.

The wedge portion 9W is so formed as to provide a thin walled portion in an upward direction by forming the clamp surface 9C as an inclined surface. Further, the wedge portion 9W is formed with a projection portion 9P engageable with the pressing-down and fixing section 11C of the upper-tool pressing-down and fixing member 11.

Further, the upper tool 9 is formed with a lower end work processing portion 9M for bending a workpiece W in co-operation with a lower tool 59 mounted on a lower table 57 of the press brake.

In the following the upper holding device is briefly elucidated, so as to make the interaction

between the upper tool 9 and the upper holding device 1 and the tool exchange procedure better understandable.

As shown in Figs. 1 and 2, the upper holding device includes a holder body 5 removably mounted on the lower part of an upper table 3 of a press brake (not shown); the support plate 7 formed integral with the lower part of the holder body 5; the upper-tool pressing-down and fixing member 11 for pressing-down and fixing the upper tool 9 between the upper-tool pressing-down and fixing member 11 and the support plate 7; a clamping-force producing device 13 for producing the clamping force of the upper-tool pressing-down and fixing member 11, and a clamp releasing device 15 for releasing the upper tool 9 from the upper-tool pressing-own and fixing member 11.

In more detail, the holder body 5 is formed with an upper block portion 5B having a hick wall in the front and rear direction (in the right and left direction in Fig. 2). The support plate 7 is formed integral with the lower part of the upper block portion 5B. To the front surface (on the left side in Fig. 2) of the upper block portion 5B of the holder body 5, a mounting plate 19 projecting upward is mounted with the use of a plurality of bolts 17 (see Fig. 1).

The holder body 5 can be mounted on the upper table 3 by bringing the mounting plate 19 into contact with the front lower portion of the upper table 3 and by fastening a clamp jaw 23 with the use of fastening bolts 21 screwed into the upper table 3.

A wedge member 25 is interposed between the upper surface of the holder body 5 and the upper table 3 to adjust the vertical position of the holder body 5.

In the structure as described above, under the condition that the clamp jaw 23 is slightly fastened against the mounting plate 19 to such an extent that the holder body 5 will not drop, it is possible to adjust the vertical position of the holder body 5 finely in the downward direction by striking the wedge member 25 slightly.

The upper-tool pressing-down and fixing member 11 is formed with a plate-shaped member having a width roughly the same as that of the holder body 5 in the right and left direction in Fig. 1, and pivotally supported by the holder body 5 so as to fix the upper tool 9 in cooperation with the support plate 7.

In more detail, the upper-tool pressing-down and fixing member 11 is formed with through holes 11H at roughly the middle portion (in the vertical direction) thereof (see Fig. 2), and pivotally supported by a plurality of mounting bolts 27 passed through the through holes 27H and screwed in the horizontal direction into the support plate 7. To facilitate the pivotal motion thereof, a spherical washer 29 is interposed between a head portion 27H of each of the mounting bolts 27 and the upper-tool pressing-down and fixing member 11. In addition, a weak coil spring 31 is elastically disposed between the upper-tool pressing-down and fixing member 11 and the support plate 7 so that the two members 11 and 7 are urged to be away form each other.

On the lower portion of the upper-tool pressing-down and fixing member 11, two pressing-down and fixing sections 11C are projectingly formed to press the upper tool 9 against the support plate 7 for clamping the upper tool 9. In addition, a push member 33 for pressing the upper tool 9 is mounted on the pressing-down and fixing section 11C with a bolt 35.

The clamp releasing device 15 is provided on the upper portion of the upper-tool pressing-down and fixing member 11 to release the upper tool 9 clamped by the pressing-down and fixing section 11C of the upper-tool pressing-down and fixing member 11.

The clamp releasing device 15 includes a fastening screw 37 screwed into the upper portion of the upper-tool pressing-down and fixing member 11, and a lever 39 is attached to this fastening screw 37.

Accordingly, when the lever 39 is pivoted, it is possible to fasten and unfasten the fastening screw 37. Further, to limit the operational (pivotal) range of the lever 39, two right and left limit pins 41 are implanted on the mounting plate 19.

The clamping-force producing device 13 includes an adjust screw 45 engaged with a nut member 43 for relative positional adjustment, a ring member 47 fitted to the adjust screw 45 so as to be movable in the axial direction, a strong elastic member 49 (a coil spring or a disk spring or urethane rubber) elastically interposed between the head portion 45H of the adjust screw 45 and the ring member 47, as shown in Fig. 2. The clamping-force producing device 13 is disposed in a horizontal inner hollow portion 5H formed in the upper block portion 5B of the holder body 5.

In the above-mentioned structure, it is possible to adjust the elastic force (the compressive condition) of the elastic member 49 by adjusting the engage position between the adjust screw 45 and the nut member 43.

Further, a contact member 51 in contact with the front end portion of the fastening screw 37 is formed integral with the ring member 47. A head portion 45H of the adjust screw 45 is in contact with the side wall of the hollow portion 5H.

In the structure as described above, under the condition that the upper tool 9 is clamped between the support plate 7 of the holder body 5 and the

upper-tool pressing-down and fixing member 11 as shown in Fig. 2, when the lever 39 of the clamp releasing device 15 is pivoted clockwise to a position R in Fig. 1 to fasten the fastening screw 37, because of the elastic member 49 being further compressed, the elastic force of this elastic member 49 is further increased, so that it is possible to fasten the upper tool 9 by a still stronger fastening force.

In contrast with this, when the lever 39 is pivoted counterclockwise to a position L in Fig. 1 to unfasten the fastening screw 37, it is possible to release the fixed upper tool 9 from the fixed condition.

As described above, when the lever 39 is pivoted to fix or release the upper tool 9, the upper-tool pressing-down and fixing member 11 is pivoted in the right and left directions in Fig. 2 on the mounting bolts 27 acting as pivot centers.

As shown in Fig. 1, a plurality of small piece members 53 are attached to the holder body 5 with bolts 55 so as to be brought into contact with the upper surface of the upper-tool pressing-down and fixing member 11, in order to guide the pivotal motion of the upper-tool pressing-down and fixing member 11 and further to restrict the upward movement of the upper-tool pressing-down and fixing member 11. Accordingly, the upper-tool pressing-down and fixing member 11 can press down and fix the upper tool 9 without moving in the vertical direction.

In the structure as described above, the upper tool 9 is mounted on the upper tool holding device 1 in accordance with the following procedure:

First, the lever 39 of the clamp releasing device 15 is pivoted in the clockwise direction to hold the fastening screw 37 in the fastened condition. Even under the condition that the fastening screw 37 is fastened as described above, the push member 33 formed at the lower portion of the upper-tool pressing-down and fixing member 11 is kept away from the support plate 7.

Accordingly, as shown by phantom lines in Fig. 2, it is possible to insert the upper thin walled portion of the wedge portion 9W of the upper tool 9 into between the support plate 7 and the upper-tool pressing-down and fixing member 11 in the horizontal direction so that an upper projection portion 9P of the upper tool 9 is engaged with the pressing-down and fixing section 11C of the upper-tool pressing-down and fixing member 11.

Thereafter, the movable side of the upper or lower table 3 or 57 is moved up and down to engage the upper tool 9 with the lower tool 59, with the result that the upper tool 9 is moved upward relative to the holder body 5.

When the upper tool 9 is relatively moved gradually toward the holder body 5, because of the push member 33 of the upper-tool pressing-down and fixing member 11 being pushed toward the left in Fig. 2 by the inclined clamp surface 9C of the upper tool 9, the upper-tool pressing-down and fixing member 11 is pivoted in the clockwise direction in Fig. 2, so that the elastic member 49 of the clamp force adjusting device 13 is compressed gradually.

Accordingly, when the contact surface 9F of the upper tool 9 is brought into contact with the lower end surface 7E of the support plate 7, it is possible to obtain such a condition that the wedge portion 9W of the upper tool 9 is fastened and fixed strongly by the upper-tool pressing-down and fixing member 11 which is urged in the counterclockwise direction by the elastic force of the elastic member 49. Therefore, it is possible to easily mount the upper tool 9 on the upper tool holding device 1.

The upper tool 9 can be removed from the upper tool holding device 1 as follows:

First, the lever 39 of the clamp releasing device 15 is pivoted in the counterclockwise direction to loosen the fastening force of the fastening screw 37, so that the upper tool 9 is released from the upper-tool pressing-down and fixing member 11. When the fastened condition of the upper tool 9 is released and therefore the upper tool 9 is moved downward by its weight, the projection 9P of the wedge portion 9W of the upper tool 9 is engaged with the clamp portion 11C of the upper-tool pressing-down and fixing member 11, so that it is possible to prevent the upper tool 9 from being dropped.

As described above, under the condition that the upper tool 9 is released from the fastening or fixed condition, when the upper tool 9 is moved in the horizontal direction, it is possible to easily remove the upper tool 9 from the upper tool holding device 1.

In other words, in the embodiment according to the present invention, it is possible to easily exchange the upper tool 9 clamped by the upper holding device 1 with another upper tool, in spite of such a simple structure as described above, without use of any tools.

Claims

1. An upper tool (9) for a press brake, comprising a shank to be clamped to a support body (5) mounted on an upper table (3) by a clamping force of a pressing-down and fixing member (11), **characterised in that** said shank is formed with an inclined surface (9c) for gradually increasing the clamping force of the pressing-down and fixing member (11) to said upper tool (9) by relative movement of said upper tool (9) to the support body (5).

2. An upper tool (9) for a press brake according to claim 1, wherein said pressing-down and fixing member (11) is attached to the support body (5) by an attaching member (27) so that the pressing-down and fixing member (11) can pivot on the attaching member (27), and said pressing-down and fixing member (11) presses and fixes said upper tool (9) to said support body (5) by being urged by a clamping-force producing device (13).

3. An upper tool (9) for a press brake according to claim 1 or 2, wherein a dimension of said inclined surface in a vertical direction, when an upper projection portion (9P) of said upper tool engages the pressing-down and fixing member (11), is more than a gap between a lower surface (7E) of the support body (5) and a shoulder portion (9F) of said upper tool (9).

4. An upper tool (9) for a press brake, adapted to be attached on an upper tool holding device (1) mounted on an upper table (3) of the press brake, comprising a work processing portion (9M) for processing a workpiece (W) in co-operation with a lower tool (59), **characterised by** a wedge portion (9W) having a contact surface (9F) brought into contact with a lower surface (7E) of a support plate (7) provided on a holder body (5) of the upper tool holding device (1), a slide surface (9S) slidably brought into contact with a front or rear surface of the support plate (7), and a clamp surface (9C) brought into pressure contact with a pressing-down and fixing section (11C) of an upper-tool pressing-down and fixing member (11) of the upper tool holding device (1).

5. Upper tool (9) for a press brake according to claim 4 or 5, wherein said wedge portion (9W) is formed, on the upper side thereof, with a projecting portion (9P) engageable with the pressing-down and fixing section (11C) of the upper-tool pressing-down and fixing member (11).

6. Upper tool for a press brake according to claim 4 or 5, wherein said clamp surface (9C) is inclined with respect to said slide surface (9S), such that said wedge portion (9W) tapers continuously towards the upper side thereof.

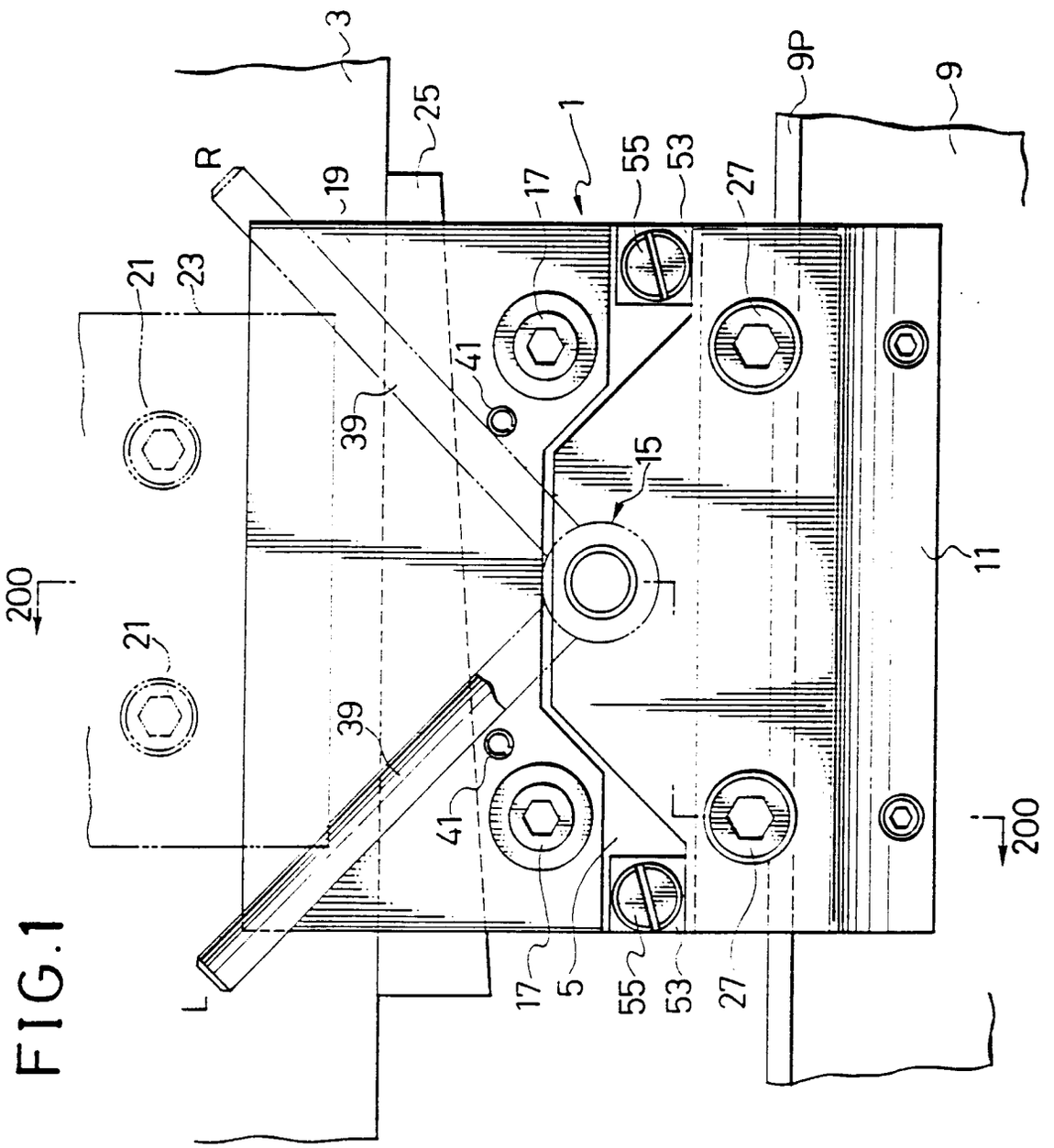
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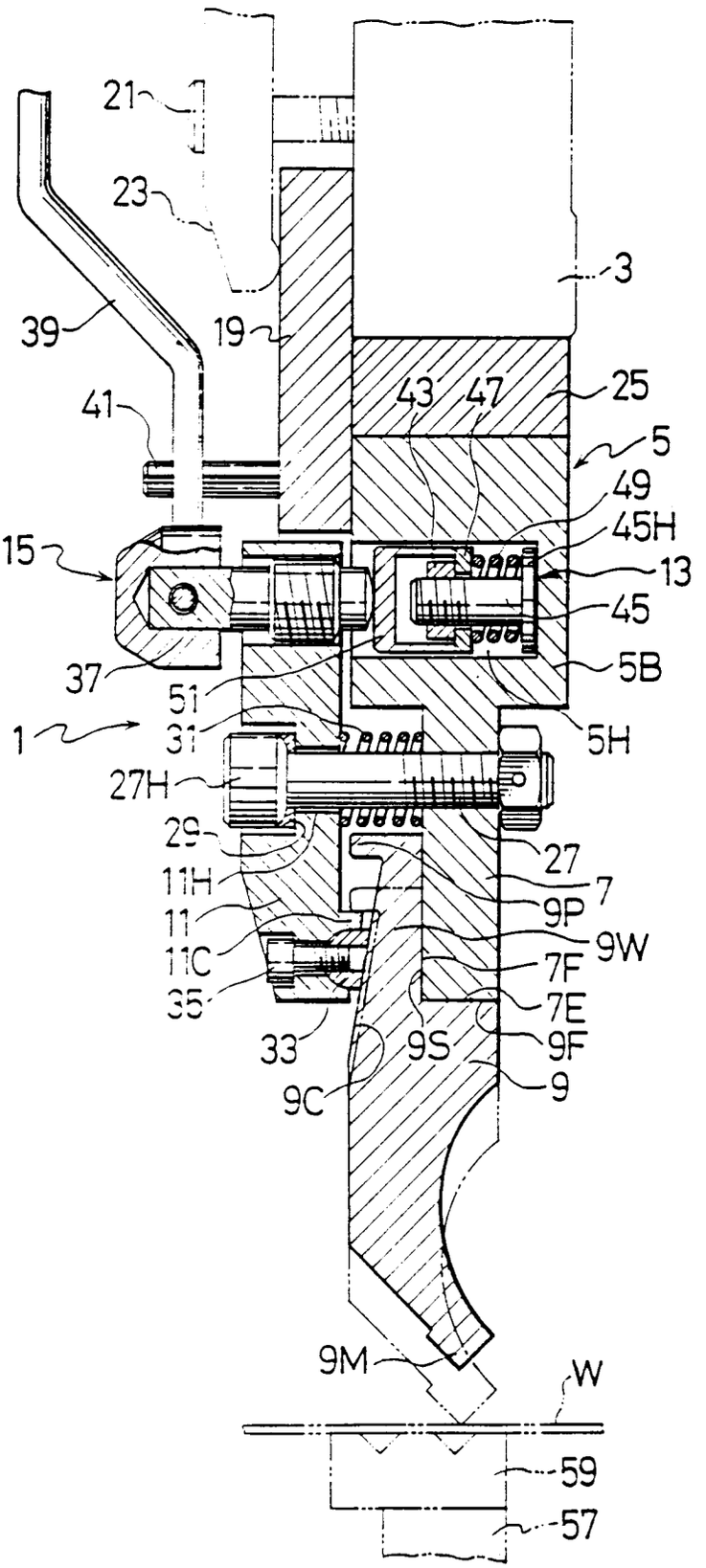
FIG.1

FIG. 2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