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METAL BENDING BRAKE WITH REARWARDLY
SLIDABLE CLAMPING BEAM

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2 Sheets-Sheet 1

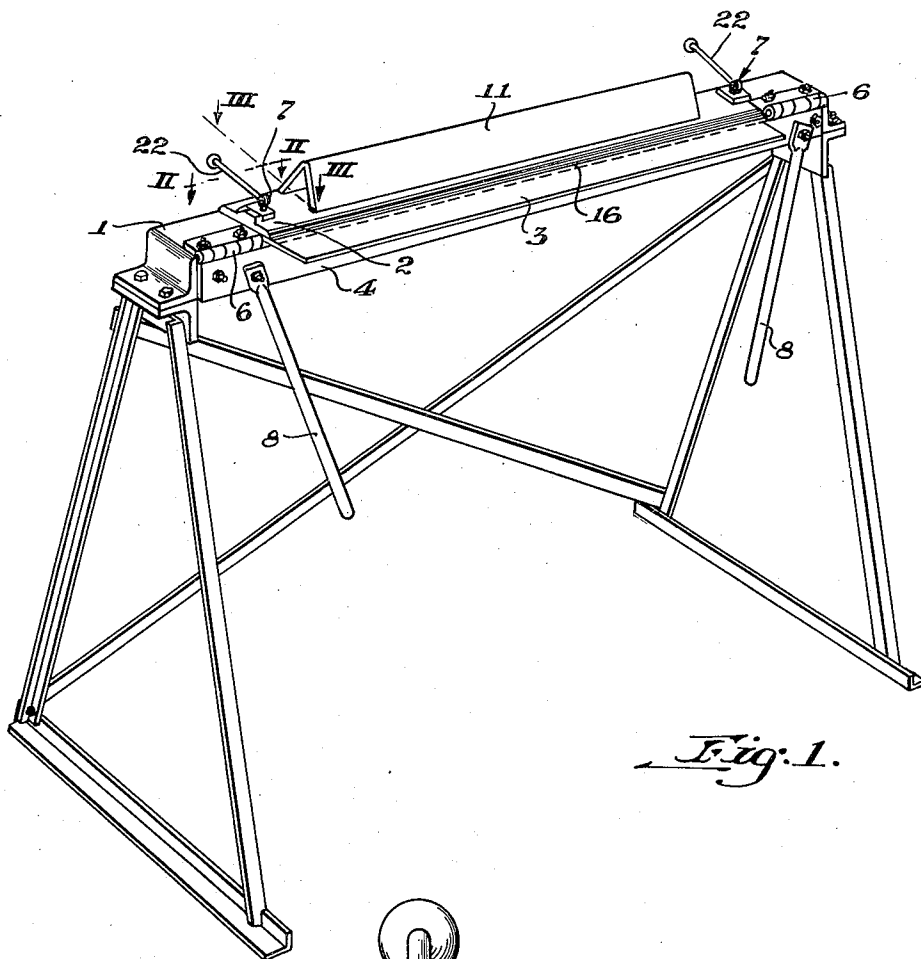


Fig. 1.

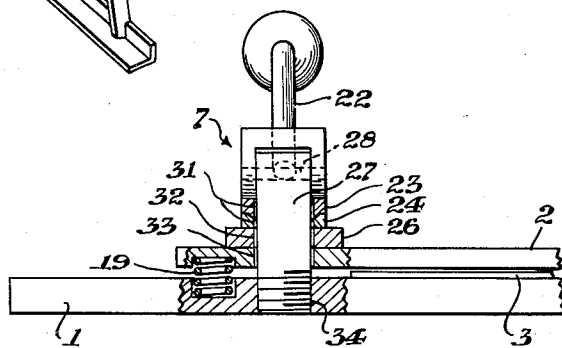


Fig. 2.

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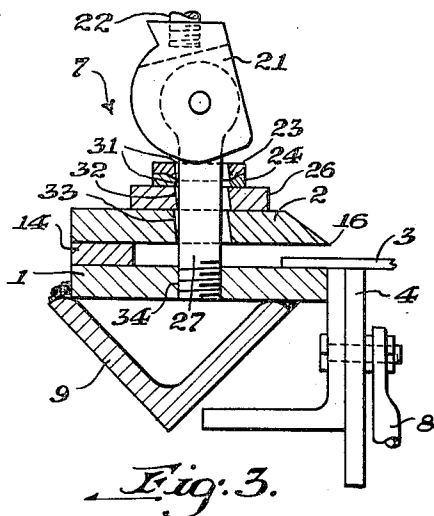
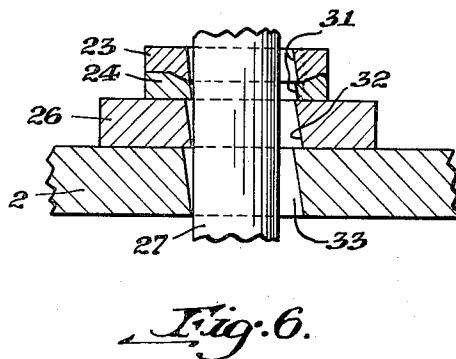
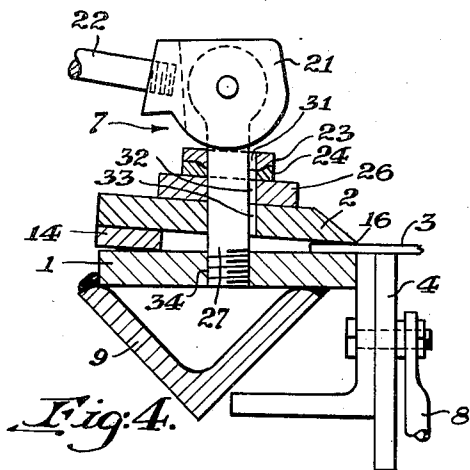
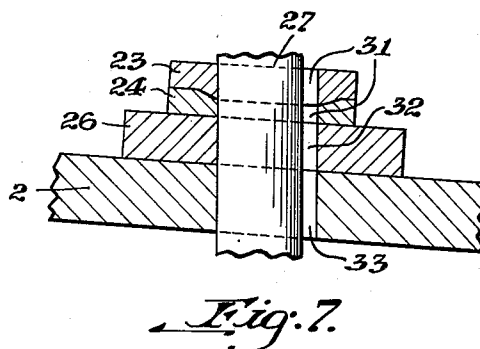
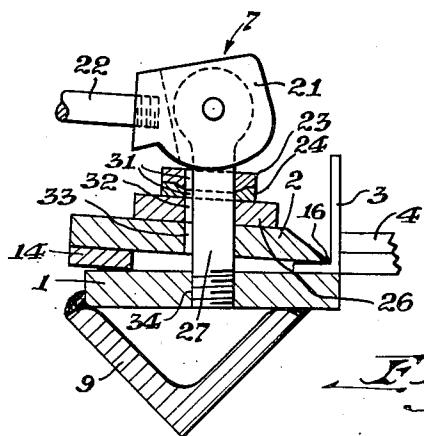
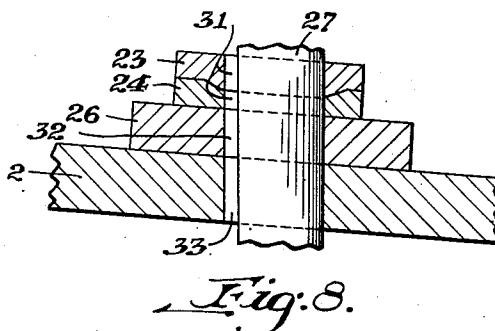
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UNITED STATES PATENT OFFICE

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METAL BENDING BRAKE WITH REARWARDLY SLIDABLE CLAMPING BEAM

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3 Claims. (Cl. 153-16)

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This invention relates to metal bending machines and, in particular, to sheet metal bending brakes.

Such brakes customarily include a bedplate to which is pivoted a metal bending beam and on which rests a metal clamping beam, and the bend is made by clamping the metal between the clamping beam and the bedplate and swinging the bending beam up against the clamping beam. Usually, the clamping beam is provided with a beveled front or working edge to permit bends greater than 90° and, in metal clamping position, this edge is closely aligned with the front edge of the bedplate and the working edge of the bending beam. One disadvantage of prior brakes is that their bends either are not as sharp as desired or the bending deforms the metal. This is due to the fact, since no adequate provision is made for the thickness of the metal being bent, when the bending beam presses the metal against the aligned working edge of the clamping beam, either one or the other of these members must give a distance equal to the gauge of the metal, or the metal itself will be pinched and possibly torn. Attempts have been made to overcome this which, generally, provide means, such as a setscrew or the like, by which the position of the clamping beam can be adjusted manually so as to place the working edge of that beam back from the bending beam a distance equal to the gauge of the metal being bent. This is unsatisfactory since time-taking manual adjustments must be made for each different gauge of metal and also because it is difficult to make accurate manual adjustments. Further, the use of such adjusting mechanism results in undesirably rounded bends since, during the initial swing of the bending beam, there is no surface abutting the metal and, consequently no initial sharp crease is formed in the metal.

It is therefore an object of this invention to provide a metal bending brake in which, during the bending operation, the clamping beam automatically adjusts itself to the proper position for making sharp bends.

A more specific object is to provide a brake in which the clamping beam is so mounted that during the metal clamping operation, its working edge moves automatically into alignment with the front edge of the bedplate, and, during the metal bending operation, gradually retreats from such aligned position a distance equal to the gauge of the metal.

A further object is to provide such a brake with

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mechanism for clamping the metal, which exerts a forward pressure on the clamping beam and evenly distributes the clamping pressure throughout the clamping beam before and during the bending operation.

According to the invention, a spacing member or block is provided which spaces the rear portion of the brake's clamping beam from the bedplate so that the beam is rockably mounted thereon. The beam is provided in the usual manner with a front beveled edge which, when the beam is rocked to clamping position, engages and clamps the metal which is inserted between it and the bedplate. The rocking motion is imparted to the beam by metal clamping mechanism which, when tightened, exerts pressure on the beam, this mechanism being mounted at each end of the clamping beam in aligned holes and openings provided in the bedplate and the clamping beam respectively. The openings in the clamping beam are made larger than that portion of the clamping mechanism received therein so that the beam is free to tilt in the openings and permit the rocking motion, and the beam is sized so that, when rocked, its beveled front edge swings into exact alignment with the front edge of the bedplate. Further, the openings are so formed that when the bending beam is swung upwardly to bend the metal the clamping beam is free to move rearwardly in the openings at least a distance equal to the gauge of the metal. In operation, the increasing pressure of the metal being bent gradually forces the clamping beam to retreat so that no unnecessary strains are set up in the metal and the bends will be as sharp as possible.

The preferred embodiment of the invention is illustrated in the accompanying drawings of which Fig. 1 is a perspective view of a brake employing the invention; Figs. 2 and 3 are sections along the lines II-II and III-III, respectively, of Fig. 1; Figs. 4 and 5 are views similar to Fig. 3 showing other metal bending positions; and Figs. 6, 7 and 8 are enlargements of Figs. 3, 4 and 5, respectively, illustrating the rocking and sliding movements of the clamping beam.

Referring to the drawings, the brake illustrated in Fig. 1 is constructed for the most part like that described and claimed in my copending application Serial Number 724,809, filed January 28, 1947, which includes a bedplate 1 and clamping beam 2 between which is clamped a metal sheet 3, and a bending beam 4 is pivotally swung to the bedplate by means of hinges 6. In operation, the metal is clamped in the machine by

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means of cam mechanism 7 which bears against the bedplate, and the bend made by swinging the bending beam upwardly against the clamping beam by means of handles 8 attached at its ends. In order to provide the brake with sufficient rigidity and strength to bend the gauges of metal normally used, the bedplate and clamping beam each are reinforced by angles 9 and 11, and the bending beam is formed of an angle. This construction provides an unusually light and strong brake which can be easily carried to the location of the job, and in addition, a brake which is capable of performing the work exceptionally fast due principally to the speed with which the cam mechanism can be operated to clamp or release the metal.

One feature of the invention is the fact that clamping beam 2 is movably mounted with respect to the bedplate in such a manner that the beam automatically positions itself before and during the bending, in the best position for making sharp bends in the metal. To accomplish this, instead of allowing the clamping beam to rest flush, in the usual manner, against the bedplate, spacing blocks 14 are disposed between these members at their rear portions so that the clamping beam rests in a tilted position with only its front edge 16 contacting the bedplate, this front edge being beveled back and being the working edge around which the metal is bent. Preferably, two square spacing blocks 14 are employed, one at each end of the clamping beam, and the blocks are integrally formed on or welded to the beam, but it should be noted that it would also be possible to use concave spacers and secure them either to the clamping beam or the bedplate.

As previously stated, cam mechanism is used to press the clamping beam into metal clamping position, and, when operated, it acts to rock the clamping beam on spacing blocks 14 and arcuately swing beveled edge 16 of the beam into clamping position. When the metal is clamped it is held between the bedplate and front beveled edge 16 of the beam and, as shown in Figs. 2 and 3, when the cams are released, coil springs 19, mounted between the beam and plate, lift the beam clear of the plate. Although the preferred cam mechanism is the same as that previously described in the copending application above referred to, it nevertheless is particularly well adapted for use with the improvements of this invention and to obtain these improvements it is mounted in a special manner. The mechanism, which is provided at either end of the clamping beam, includes a cam 21 into which is threaded a cam handle 22, and the cam bears against a pair of cam discs 23 and 24 which in turn bear against a cam plate 26 resting on the clamping beam. Cam 21, as shown in Fig. 2, has a pair of bifurcated cam arms between which a setscrew 27 is mounted on a pivot pin 28, the setscrew extending downwardly through aligned openings 31, 32 and 33, provided in the cam discs, cam plate and clamping beam respectively, and being tightly secured in the bedplate in a threaded hole 34 which is positioned in axial alignment with the openings.

The cam mechanism is specially mounted in a manner which permits the rocking motion of the clamping beam and also permits a horizontal movement of the beam during bending. Generally, these motions are permitted by making the diameter of the aligned openings 31, 32 and 33 larger than the portions of the setscrew which

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extend through them and also inclining the axes of these openings rearwardly of the vertical axis of the setscrew. The amount of inclination of the openings' axes will depend on the amount of beam rocking desired, and the difference in the diameter of the screws and the openings should be at least an amount equal to the gauge of the metal being bent. It is preferable, in order to adapt the brake for bending a wide range of gauges to make this difference in diameters equal to the heaviest gauge metal which the particular machine is capable of bending.

It is felt that a description of the various steps in a bending operation illustrated in Figs. 3, 4 and 5 and the corresponding enlargements of Figs. 6, 7 and 8 will most clearly explain the reasons for this particular mounting of the clamping beam. Referring to Fig. 3, the clamping beam is shown in a raised position to permit the insertion of metal and, in this position, spacing block 14 rests flush against the bedplate and its rear wall is in vertical alignment with the rear walls of the beam and bedplate. In the enlargement of Fig. 6, it is seen that the cam setscrew extends through aligned openings 31, 32 and 33 in such a manner that it engages only the lower bottom surface of each opening and the top front surfaces of each opening are spaced forwardly of the setscrew a distance preferably equal to the gauge of the metal being bent.

In the next step, illustrated in Figs. 4 and 7, the metal has been clamped by swinging cam handle 22 backward to exert pressure on the clamping beam and rock it forwardly on spacing block 14 into a position in which its front beveled edge is in exact alignment with the front edge of the bedplate, this position being desirable so that the metal will begin to crease around the beam during the first part of the bending. By referring to Fig. 7, it will be seen that, in the clamped position, the beam has tilted about the setscrew so as to bring the axes of the openings into alignment with the setscrew and the rear surfaces of the openings and setscrew into full contact with each other. Also, in this position the front surfaces of the openings are spaced forwardly of the setscrew an amount equal to the differences in diameters of the screw and openings, and this amount represents the gauge of the metal being bent.

In the final bending step illustrated in Figs. 5 and 8, bending beam 6 has been swung upwardly through 90° from its normal position. During the bending, the thickness of the metal has exerted increasing lateral rearward pressure on the clamping beam until the beam has been finally moved to the full extent permitted by the differences in diameters of the openings and the setscrew. This fact is apparent from the position of the setscrew with respect to the openings shown in Fig. 8, and also from the fact that, as shown in Fig. 5, the rear end wall of the beam has been forced out over the rear wall of the bedplate. As the beam is forced rearwardly against the forward pressure of the cams the normal friction which would be present is reduced due to the fact that it is riding only on the forward edge of the spacing block. Another apparent but important function occurring during this movement of the clamping beam is that the beam is pushed by the metal directly in front of the initial crease so that the final bend is made around the initial crease and unusually sharp bends result. After the bend has

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been completed, the cam mechanism is released, the clamping beam automatically returning to its Fig. 3 position by the extension of the lifting coil springs 19.

One further feature of the invention, which should now be readily understandable, lies in the use of the particular cam mechanism described. Thus, when the mechanism is tightened against the rockable beam it exerts a forward as well as a downward pressure, so that the pressure exerted by the metal as it is bent must overcome this forward pressure with the result that the backward movement of the beam is gradual and not sudden as might be the case with other clamping devices. Further, the lower face of upper disc 23 is convex while the upper face of the lower disc is concave so that the clamping pressure is evenly distributed. Such matching spherical radii discs are well known but are of particular value in maintaining even pressure distribution during the beam's rocking and lateral movement.

According to the provisions of the patent statutes, I have explained the principle and construction of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. A sheet metal bending brake comprising a bedplate provided at its ends with holes, a clamping beam having a beveled front edge and openings aligned with said bedplate holes, a spacing member disposed between the rear portions of said plate and beam, a bending beam pivotally secured to said bedplate, clamping beam lifting means for raising said beveled front edge clear of said plate to permit the insertion of metal therebetween, and metal clamping cam mechanism received in said aligned holes and openings, said mechanism being loosely mounted in said clamping beam openings and said openings being larger than the portion of the cam mechanism received therein and having their axes inclined rearwardly of the vertical so as to permit said clamping beam to rock forwardly and position its beveled edge in exact alignment with the forward edge of the bedplate when said cam mechanism is tightened and also to permit the beam to slide rearwardly when said metal is being bent at least a distance equal to the gauge of said metal, whereby a sharp bend is formed in said metal.

2. A sheet metal bending brake comprising a bedplate provided at its ends with holes, a clamping beam having a beveled front edge and openings aligned with said bedplate holes, a spacing member disposed between the rear portions of said plate and beam, a bending beam pivotally secured to said bedplate, clamping beam lifting means for raising said beveled front edge clear of said plate to permit the insertion of metal therebetween, and cam clamping mechanism received in said aligned holes and openings, said mechanism including a setscrew secured in said

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bedplate hole, a cam associated with said setscrew and a cam plate disposed between said cam and clamping beam, said plate having an opening aligned with each of said clamping beam openings and said setscrew projecting upwardly through said aligned openings, said aligned openings being larger than said setscrew received therein and having their axes inclined rearwardly of the vertical so as to permit said clamping beam to rock forwardly and position its beveled edge in exact alignment with the forward edge of the bedplate when said cam mechanism is tightened and also to permit the beam to slide rearwardly when said metal is being bent at least a distance equal to the gauge of said metal, whereby a sharp bend is formed in said metal.

3. A sheet metal bending brake comprising a bedplate provided at its ends with holes, a clamping beam having a beveled front edge and openings aligned with said bedplate holes, a spacing member disposed between the rear portions of said plate and beam, a bending beam pivotally secured to said bedplate, clamping beam lifting means for raising said beveled front edge clear of said plate to permit the insertion of metal therebetween, and cam mechanism received in said aligned holes and openings, said mechanism including a setscrew secured in said bedplate hole, a cam associated with said setscrew, a pair of upper and lower cam discs, said upper disc bearing against said cam and having a lower convex face and said lower disc having an upper concave face receiving said convex face of the upper disc, and a cam plate disposed between said lower disc and clamping beam, said discs and cam plate each having an opening aligned with each of said clamping beam openings and said setscrew projecting upwardly through said aligned openings, said aligned openings being larger than said setscrew received therein and having their axes inclined rearwardly of the vertical so as to permit said clamping beam to rock forwardly and position its beveled edge in exact alignment with the forward edge of the bedplate when said cam mechanism is tightened and also to permit the beam to slide rearwardly against the forward pressure of said cam mechanism when said metal is being bent at least a distance equal to the gauge of said metal.

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