Jan. 28, 1936. J. JENSEN 2,028,869

BENDING BRAKE

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Fig. 1

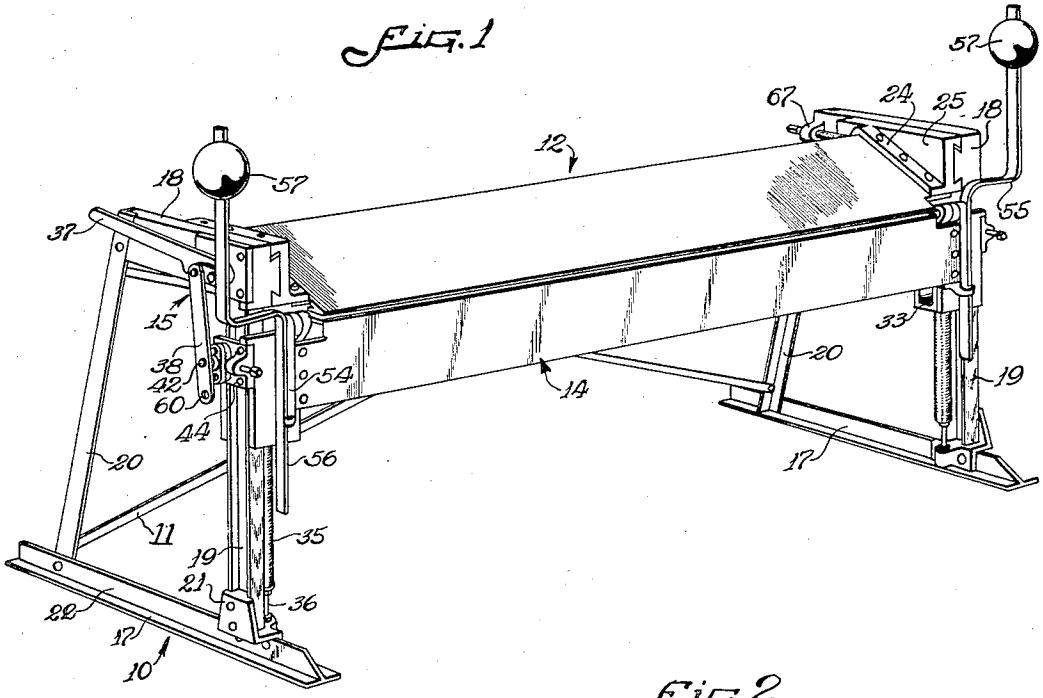

Fig. 2

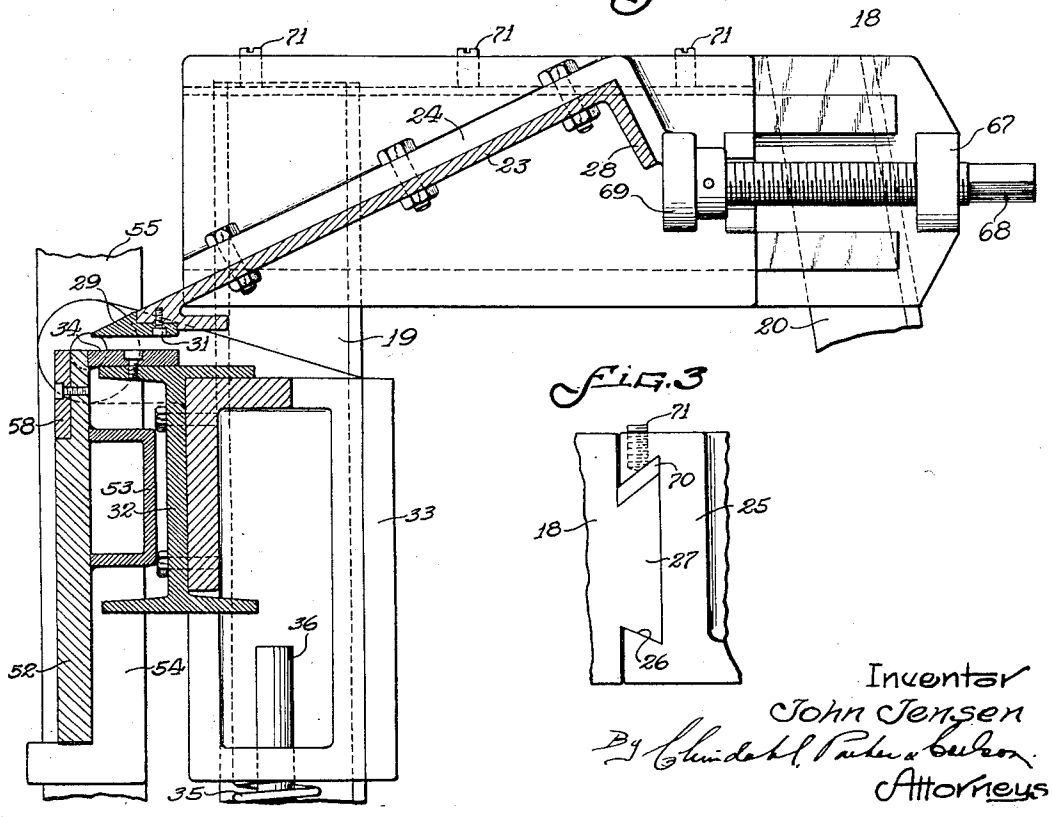

Fig. 3

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BENDING BRAKE

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Fig. 4

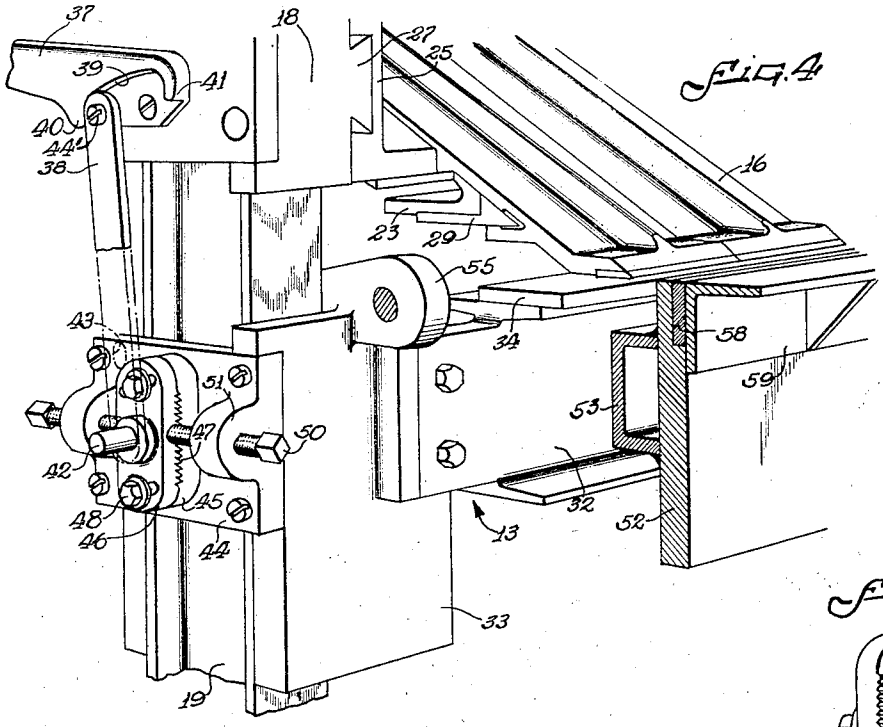


Fig. 5

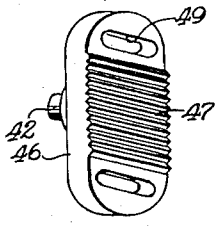


Fig. 6

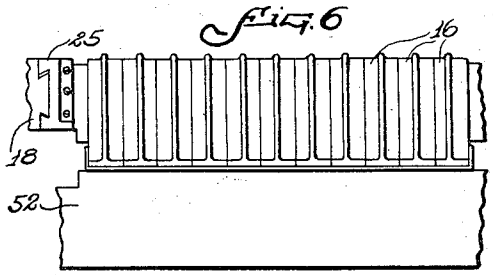
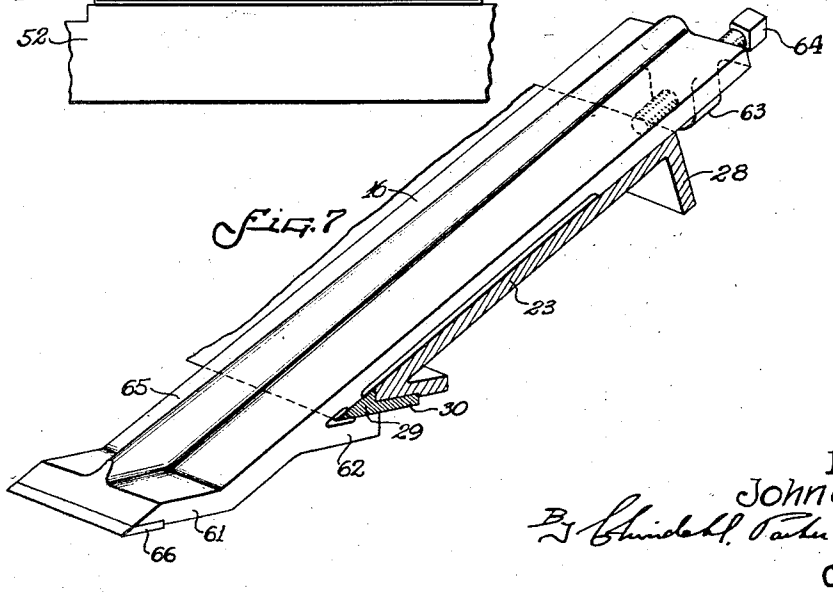


Fig. 7



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UNITED STATES PATENT OFFICE

2,028,869

BENDING BRAKE

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Application January 5, 1933, Serial No. 650,235

18 Claims. (Cl. 153—16)

The invention relates to a brake for bending metal and has as a general object the provision of a machine of simple construction having a wide range of utility.

More particularly stated one object of the invention is to provide a simple bending brake easily and quickly convertible to perform a number of operations usually performed on separate machines.

Another object is to provide a machine of the character described which is easily and accurately adjustable to bend metal sheets of different thickness.

Other objects and advantages will become apparent from the following detailed description taken in connection with the accompanying drawings in which:

Figure 1 is a perspective view of a brake embodying the features of the invention.

Fig. 2 is a fragmental vertical transverse sectional view taken near one end of the brake.

Fig. 3 is an enlarged detail view of the platen guide ways.

Fig. 4 is a fragmental perspective view of the machine when adapted for box braking.

Fig. 5 is an enlarged view of one element of the table adjusting means.

Fig. 6 is a fragmental view taken from the front of the machine showing finger attached to the platen to adapt the machine for box braking.

Fig. 7 is a perspective view of a finger attached to the platen.

The invention in the embodiment selected for purposes of illustration, comprises, in general, a framework consisting of end frames 10 and cross braces 11 connected between the frames to hold them in upright position. Fixedly supported between the end frames 10 is a horizontally disposed platen 12 sloping downwardly and forwardly to terminate in a continuous bending edge extending over substantially the entire distance between the end frames; and guided by the end frames 10 for movement toward and away from the platen 12 is a bed 13 positioned below the platen and serving to clamp between the bed and the platen the sheet of metal to be operated upon. An apron 14 is hingedly connected to the bed 13 and is swingable forwardly and upwardly to bend the sheet of metal secured between the bed 13 and platen 12. Movement of the bed 13 toward and away from the platen 12 is effected by lever mechanisms 15 located at opposite ends of the brake and connected between the frames and the bed.

The utility of the brake is increased by constructing the same to be convertible into a box braking machine. Generally stated, this is accomplished herein by spacing the bed 13 relative to the continuous bending edge of the platen 12 in order thereby to accommodate any upstanding, transversely extending edges of the box to be operated upon, and by providing a bending edge which cooperates with the bed in its spaced position and is made adjustable so as to be of any desired length, and either continuous or discontinuous. Spacing of the bed 13 relative to the continuous edge of the platen 12 is effected by means of the lever mechanisms 15 which are capable of supporting the bed either in a raised position adjacent the platen or in a lowered position spaced from the platen. To provide the bending edge, fingers 16 are applied to the platen 12 in any number and arrangement, and in such a way as to project downwardly and forwardly; and to enable the edge of the fingers 16 to be positioned properly with respect to the axis of the apron 14, the platen is rearwardly adjustable.

Referring now to the particular construction employed in the present machine, each of the end frames 10 is composed of a base 17 extending transversely of the brake, and a head-block 18 supported by uprights 19 and 20 constituting respectively the front and rear of the end frame. The front upright 19 is H-shaped in cross section. At its lower end, the upright 19 is secured to a shoe 21 riveted to an upstanding flange 22 of the base 17 and at its upper end projects into and is secured in a recess formed in the head-block 18 for that purpose. The rear upright 20 is an angle iron riveted at its ends to the base 17 and the head-block 18.

The platen 12, supported between the end frames 10, herein is fixed against vertical movement but is adjustable laterally of the machine, and comprises a forwardly and downwardly inclined plate 23 bolted at each end to a flange 24 on slides 25 supported on the head-blocks 18 of the end frames. Each of the slides 25 is formed with a groove 26 to receive a horizontal, dovetail way 27 on the head-block 18. The rear edge of the plate 23 terminates in a flange 28 projecting downwardly substantially at right angles to the plate, while the forward edge carries a blade 29 constituting the bending edge proper of the platen. The blade 29 has a rearwardly projecting flange 30 to provide a plane, horizontal surface of substantial width and is removably attached to the plate 23 by countersunk screws 31.

Cooperating with the platen 12 to support and

to secure the sheet of metal to be operated upon is the bed 13. The latter is positioned below the forward edge of the platen 12 and is movable toward and away from the platen to secure or release a sheet of metal. In such movements, the bed 13 is guided by the front uprights 19 of the end frames.

In the main, the bed 13 consists of an I-beam 32 bolted at its ends to box-like brackets 33 slidable on the uprights 19. Removably attached to the top of the I-beam and projecting slightly beyond its forward edge is a strip 34 approximately of the same width as the blade 29 attached to the plate 23. It is between the blade and the strip that the sheet of metal to be bent is clamped. The blade and the strip are removably attached in order that they may be easily replaced in case the edges are injured.

Preferably the weight of the bed is partially counter-balanced. Herein compression springs 35 are employed for that purpose. Projecting upwardly from each of the shoes 21 and into the bracket 33 above is a rod 36 over which one of the springs 35 is placed. At the upper end, the spring 35 bears against the bracket 33, while at the lower end the spring is adjustably attached to the rod 36 so that the counter-balancing effect of the spring may be varied.

Support of the bed 13 in a raised position adjacent the platen 12 and movement of the bed toward and away from the platen are effected by the separate mechanisms 15 mounted at each end of the brake and preferably independently operable. One of the mechanisms is shown in Fig. 1 and comprises a lever 37 pivoted on the end frame 10 and a depending link 38 pivoted at one end on the lever 37 and having a connection at the other end with the bed 13. In the horizontal position of the lever 37 shown in Fig. 1 the bed 13 is removed from the platen 12 and permits the withdrawal or insertion of a sheet of metal which then may be clamped by swinging the lever 37 upwardly to a substantially vertical position.

In order that lever 37 may be retained in its substantially vertical position, the lever 37 and the link 38 are arranged to constitute an over-center device. Accordingly, the lever 37 is enlarged at its pivoted end and formed with a recess 39 opening along one edge of the lever. The link 38 is connected to the lever 37 at a point within the recess 39 intermediate the fulcrum of the lever and the remote end thereof. In the horizontal position of the lever 37 (see Fig. 4) the link 38 abuts a stop 40 formed by the edge of the recess 39 and thus prevents further swinging of the lever 37 and consequently limits the downward movement of the bed 13. Similarly the link 38 abuts a stop 41, formed by the opposite edge of the recess, when the lever 38 has been swung upwardly beyond over-center position, whereby the lever is locked in that position and the bed retained in clamping position.

The connection between the bed 13 and the link 38 is of a character to permit of easy disconnection and is formed herein by a pin 42 projecting through a hole 43 in the link 38. The pin 42 is carried by a plate 44 bolted to the bracket 33 across the legs thereof. The plate 44 serves as the immediate connection with the bed as well as to aid in retaining the bracket 33 slidable on the upright 19. The link 38 may be withdrawn from the pin 42 by removing a screw 44' by which the link 38 is attached to the lever 37.

In order that the bed 13 and platen 12 may clamp sheets of different thickness, adjusting means is provided. Herein this means is interposed between the bed 13 and the link 38 of each of the lever mechanisms, and consists of a pair of elongated blocks 45 and 46 arranged in effect to lengthen or shorten the link 38 by relative movement of the blocks. The block 45 is rigid with the plate 44 and positioned in face to face relationship with it is the block 46 from which the pin 42 projects. The adjacent faces of the blocks have interfitting serrations 47 inclined slightly from the horizontal so that upon lateral movement of the block 46 it is cammed up or down relative to the block 45 and thus in effect lengthens or shortens the link 38. Bolts 48 projecting through inclined slots 49 in the block 46 and threaded into the block 45 retain the blocks with the serrations in engaging relationship during the lateral adjustment of the block 46 and may then be tightened to prevent further movement of the block. Lateral movement is imparted to the block 46 by operating bolts 50 threaded through studs 51 on the plate 44 and bearing against the block at opposite sides thereof.

The apron 14, hingedly connected to the bed and operable to bend the sheet of metal secured between the bed and the platen, consists in the main of a normally depending leaf 52 supported with its upper, rear corner as nearly as possible coincident with the upper front corner of the strip 34 on the bed and made rigid by a channel iron 53 welded to the back of the leaf. At each end the leaf 52 is bolted to a hinge strap 54 enlarged and forked at its upper end to receive a stud 55 projecting from the bracket 33. The strap 54 is attached to the stud by a pin projecting through the stud 55 and the forked end of the strap. As is best seen in Fig. 2, the hinge axis of the apron coincides with the front corner of the strip 34 so that the upper edge of the leaf 52, which effects the bending, will remain the same distance from the corner of the strip 34 as the apron is swung about its axis. A bar 55 is secured alongside each end of the apron 14 and projects downwardly beyond the apron to form a handle 56 for swinging the apron, and projects upwardly to carry a weight 57 counterbalancing the weight of the apron.

In order that the brake be capable of making reverse bends spaced apart a distance less than the normal thickness of the leaf 52 of the apron, the upper or bending edge of the leaf 52 is formed in part by a strip 58 extending longitudinally of the apron. The strip 58 is removably attached and is shown in Figs. 2 and 4, as constituting approximately half of the thickness of the leaf 52. When the strip 58 is removed a sheet of metal bent in one direction may be reversely bent along a line spaced from the first bend a distance less than the normal thickness of the leaf 52 because the flange formed by the first bend may be received in the space formed by the removal of the strip 58. Preferably an angle iron 59 is also provided (see Fig. 4) which may be attached to the leaf 52 to support the sheet when it projects a considerable distance forwardly of the edge of the platen.

As previously stated, the utility of the brake is increased by constructing the same to be easily convertible into a box braking machine and also to be adjustable to facilitate the bending of conically shaped articles. The brake is converted into a box braking machine by spacing the bed 13 relative to the platen 12, thereby to accom-

modate any upstanding flanges on the sheet to be operated upon, and by providing a bending edge on the platen which cooperates with the bed in its spaced position relative to the platen (see Fig. 4). Herein spacing of the bed 13 is effected by means of the lever mechanisms 15 actuating the bed, and a bending edge, which will cooperate with the bed in its spaced position, is formed on the platen 12 by means of the fingers 16 adapted to be mounted on the platen.

The lever mechanisms are constructed to support the bed 13 either in a raised position adjacent the normal bending edge of the platen 12 or in a lowered position spaced from the normal bending edge of the platen and are operable with the bed in either position to move the same toward or away from the platen to secure or release a sheet of metal. Such spacing of the bed 13 is effected by varying the effective length of the connecting link between the bed 13 and the lever 37. Accordingly, each of the links 38 is formed with a second hole 60 spaced from the hole 43 the distance the bed is to be lowered. The bed is thus supported in either raised or lowered position by connecting the link 38 and the pin 42 with the pin projecting through the upper hole 43 or the lower hole 60 respectively.

Herein each of the fingers 16, constructed to be carried by the platen 12 to form a new bending edge cooperating with the bed 13 in its lowered position, is narrow and plate-like and is mounted flat on the plate 23. Each finger is longer than the plate 23 is wide, and is mounted transversely thereof with its ends projecting beyond the edges of the plate. At the lower end, the finger terminates in a horizontal portion 61 for cooperation with the strip 34 on the bed. The fingers 16 are attached in any number and grouping desired or necessary to provide a bending edge permitting the projection therethrough of a transversely-extending, upstanding flange or flanges on the sheet to be bent. Thus in Fig. 6, just a sufficient number of fingers are attached to fit between the upstanding flanges of a sheet to be formed into a box thereby permitting the flanges to project upwardly along the sides of the fingers at the ends of the row of fingers. It will be understood that more fingers might be added at the right in Fig. 6, leaving a space for the flange on the box, or the fingers may be grouped differently than shown to adapt the brake for a different size of box.

Each finger 16 has a flange 62 on its bottom side forming a wedge-shaped recess into which the blade 29 of the platen projects and a lug 63 at the upper end through which is threaded a bolt 64. The bolt 64 bears against the flange 28 of the plate 23 and when tightened secures the finger by wedging it over the plate 23. The wedge-shaped recess formed by the flange 63 is preferably enlarged at its apex so that the edge of the blade 29 is not injured in attaching fingers. The finger is strengthened by a longitudinally extending rib 65 and carries a replaceable strip 66 constituting the bending edge proper of the finger.

In order that the bending edge of the platen 12 may be positioned in the proper vertical plane relative to the axis of the apron 14, the platen is laterally adjustable on the horizontal ways 27. This adjustment is made extensive in order to assure a sufficient rearward movement of the platen properly to position the bending edge when the fingers 16 are employed. Each head-block 18, therefore, is substantially longer than the slide 25, to which the plate 23 is attached, and has integral at its rear end a lug 67. Threaded through the lug 67 is a screw 68 engaging at its inner end a lug 69 on the block 25 and having a squared outer end. The engagement between the screw 68 and the lug 69 is such as to permit of rotation of the screw, while securing the screw against relative axial movement. By turning the screw, the platen is caused to move rearwardly or forwardly until the bending edge is spaced from the vertical plane through the axis of the apron a distance equal to the thickness of the sheet to be bent.

The bending of conically shaped articles is facilitated by adjusting the platen 12 so that the bend made at one end of the machine is less than that made at the other. That is, for the same swing of the apron 14, the projecting portion of the sheet will be bent through a certain angle at one end of the machine and through a gradually smaller angle progressively along the machine to the other end. This will result in one end of the sheet having a larger radius than the other after a series of bending operations.

Such bending is effected by positioning the bending edge of the platen 12 at an angle with respect to the vertical plane passing through the axis of the apron. To permit the platen to be set at an angle there is a slight clearance at each end between the slide 25 and the head-block 18 (see Fig. 3). In addition, a gib 70 is interposed between the way 27 and the groove 26 and is adjustably retained by screws 71 to take up the play in the ways which was intentionally provided. After loosening the screws 71 the platen 12 may be set at an angle by adjusting one of the screws 68, such positioning of the platen being permitted by the clearance above mentioned and the play in the ways. Since the bend in the sheet occurs at the edge of the platen 12, it will be understood that with the platen set at an angle, the bend at one end will be close to the apron and therefore sharp, while at the other end it will be spaced from the apron and therefore less sharp, depending on the angle at which the platen is set. Thus by adjusting the platen properly, any desired difference in the sharpness of the bend may be obtained so that by a series of bending operations a sheet may be bent into a generally conical shape with the desired radius at the top and bottom.

I claim as my invention:

1. A bending brake comprising, in combination, a framework, a platen fixedly supported by said framework and providing a continuous bending edge for the bending of plane sheets, fingers adapted to be carried by said platen to provide a discontinuous bending edge for the bending of boxes, a bed guided for vertical movement by said framework, an apron hingedly connected to said bed and swingable to effect the bending, and a lever mechanism connected between said framework and said bed adjustable to support the same either in a position to cooperate with said fingers when attached or in a position to cooperate with said platen when the fingers are detached and operable with said bed in either position to move the same to clamp or release a sheet of metal between the bed and the bending edge with which it cooperates.

2. A bending brake comprising, in combination, a framework, a horizontally disposed platen supported in said framework for lateral adjustment and having a bending edge for the braking of plane metal sheets, a bed mounted

in said framework below said platen for vertical movement, a lever mechanism mounted on said framework and having a connection with said bed to support the same in raised position adjacent said platen, said lever mechanism having a second connection with said bed for supporting the same in a lower operative position spaced from said platen to receive between the platen and the bed fingers adapted to be attached over said platen to provide an edge for the braking of boxes, and operable with the bed in either position to actuate the same to clamp the work, and an apron hingedly connected to said bed.

3. A bending brake comprising, in combination, a framework, a platen fixedly supported in said framework and having a bending edge, a bed also supported in said framework and movable from one operative position toward said platen to clamp a plane sheet of metal between the bending edge and the bed, an apron hingedly connected to said bed, said platen and said bed being relatively movable into a different operative relation to receive between them fingers adapted to be attached over said platen to provide a bending edge accommodating a sheet having an upstanding flange, and means for actuating said bed from either of its said positions to clamp the work.

4. A bending brake comprising, in combination, a framework, a platen supported by said framework and having a bending edge for the bending of plane sheets, a bed also supported by said framework, said bed and said platen being arranged to clamp a sheet of metal therebetween, and an apron hingedly connected to said bed and swingable to bend the clamped sheet, said bed and said platen being relatively spaceable to receive between them an upstanding flange on the sheet to be bent and fingers adapted to be attached over said platen to provide a bending edge accommodating the upstanding flange and cooperating with said bed when it is spaced relative to said platen.

5. A bending brake comprising, in combination, a framework, a platen supported in said framework, a bed cooperating with said platen to clamp a sheet of metal therebetween, an apron swingable to bend the sheet of metal so clamped, said platen and said bed being arranged for the clamping and bending of plane sheets, and means adapting the brake for the bending of boxes including mechanism for spacing said bed and said platen relative to one another and fingers providing a new bending edge on said platen to cooperate with the bed when spaced relative to the platen.

6. In a metal brake having a framework and a platen fixedly supported in said framework, a bed guided for vertical movement by said framework, an apron hingedly connected to said bed, and mechanism for supporting said bed and moving the same toward or away from said platen to clamp or release a sheet of metal between said bed and platen comprising, a lever at each end of the brake pivoted to the framework and a link for each of the levers connected at one end to the lever to form an over-center device therewith and connected at the other end to said bed to support the same adjacent said platen, said link permitting of a second connection with said bed for supporting the same spaced from said platen.

7. A metal brake comprising, in combination, a framework, a platen supported by said framework, a bed guided by said framework for up and down movement, an apron hingedly connected to said bed, a lever mechanism operable to move said bed toward or away from said platen to clamp or release a sheet of metal, and an adjusting device interposed between said bed and said lever mechanism to adapt the bed to clamp metal sheets of different thickness.

8. In a brake, a pair of end frames, a horizontally disposed platen supported between said frames, a bed positioned below said platen and guided for vertical movement by said end frames, a lever pivoted on each end frame, a link depending from said lever, and a pin projecting horizontally from each end of said bed, said link having a plurality of spaced holes adapted to receive said pin to support said bed in various vertical positions.

9. A bending brake having a framework, an apron swingable about an axis extending longitudinally of said framework, a platen supported in said framework for adjustment laterally thereof, and means adjustable to free said platen for limited angular displacement by lateral adjustment of one end only thereby to adapt the brake for conical bending.

10. A metal brake, comprising in combination, a framework, a platen supported in said framework and providing a bending edge, a bed cooperating with said platen to clamp a sheet of metal to be bent, an apron hingedly connected to said bed and swingable about its axis to bend the sheet, the bending edge of said platen normally extending parallel with the axis of said apron, and means for positioning said platen with its bending edge at an angle with the axis of said apron to permit conical bending.

11. In a metal brake having end frames, a bed supported between said end frames, and an apron, a platen providing a bending edge normally parallel with the axis of said apron comprising, a plate carrying the bending edge, a grooved slide rigid with each end of said plate, ways on said end frames on which said grooved slides are movable, and a gib interposed between the way and the grooved slide adjustable to provide play between the slide and end frame permitting said platen to be set with its bending edge at an angle to the axis of said apron.

12. A bending brake comprising, in combination, a framework, a horizontally disposed platen fixed in said framework against vertical movement, a bed positioned below said platen and guided by said framework for vertical sliding movement relative to said platen, a bending apron hingedly connected to said bed, means for operating said bed to move it bodily toward and from said platen so as to receive and clamp a plane sheet of metal of a given thickness, said means being adjustable to support said bed in a position spaced a substantial distance from the platen to receive between the platen and the bed a sheet of metal of the same thickness but having an upstanding flange, and means cooperative with the platen and the bed in said spaced position adapted to contact said sheet and provide a bending edge.

13. A bending brake comprising, in combination, a framework, a horizontally disposed platen fixed in said framework against vertical movement, a bed positioned below said platen and guided by said framework for vertical sliding movement toward or away from said platen, a bending apron hingedly connected to said bed, and means including a link connected between the frame and the bed operable to support the bed in a position adjacent the platen and in that position to reciprocate

the bed to clamp or release a sheet of metal, said link being adjustable to support and reciprocate said bed in a second position vertically spaced a substantial distance from the first position.

14. A bending brake comprising, in combination, a framework, a horizontally disposed platen fixed in said framework against vertical movement, a bed positioned below said platen and guided by said framework for vertical sliding movement relative to said platen, a bending apron hingedly connected to said bed, and means operable to support said bed in a position adjacent said platen and to reciprocate the bed in that position to clamp a plane sheet of metal between the bed and platen, said means having a variable connection between the bed and said frame to support and reciprocate said bed in a position vertically spaced a substantial distance from said platen to condition the brake for clamping boxes.

15. A bending brake comprising, in combination, a framework, a horizontally disposed platen fixed in said framework against vertical movement, a bed positioned below said platen and guided by said framework for vertical sliding movement, means connected between said frame and said bed supporting the same and operable to reciprocate said bed toward and from said platen to clamp a sheet of metal, said means including an adjustable connection to support said bed adjacent said platen or spaced therefrom to adapt the brake for the bending of plane sheets or boxes, said means having a further and independent adjustable connection for adapting the bed to clamp plane sheets or boxes composed of metal sheets of different thickness, and an apron hingedly connected to said bed and swingable to bend the sheet of metal clamped onto the bed.

16. A bending brake comprising, in combination, an elongated supporting frame having upright standards at opposite ends thereof, a platen mounted in fixed position on said frame and providing a bending edge, guide brackets mounted on said standards for up and down movements, a bed carried by said brackets for cooperation with said platen in clamping the work, a bending apron pivotally mounted on the bed, and operating levers mounted on said frame at opposite ends thereof and each having a connection with one of said brackets adjustable to vary the range of movements of the bed relative to the movement of the platen, said connections including links eccentrically connected with the respective operating levers and operative in the work-clamping position of the bed to lock the latter positively against movement away from the platen.

17. A bending brake comprising, in combination, an elongated supporting frame having upright standards at opposite ends thereof, a platen fixedly mounted on said frame and providing a bending edge, brackets slidable on said upright standards, a bed carried by said brackets for cooperation with said platen in clamping the work, a bending apron pivotally mounted on the bed, and means mounted on the frame and operatively connected with said brackets to move the bed toward and from the platen, said operating means including levers fulcrumed on the frame, and links pivoted at one end to the respective levers eccentrically thereof and operatively connected at their other ends to said brackets, said levers being swingable to carry the link pivots into dead-center relation to the lever fulcrums in the work-clamping position of the bed, whereby to lock the bed positively against movement away from the platen.

18. A bending brake comprising, in combination, an elongated supporting frame having upright standards at opposite ends thereof, a platen fixedly mounted on said frame and providing a bending edge, brackets slidable on said upright standards, a bed carried by said brackets for cooperation with said platen in clamping the work, a bending apron pivotally mounted on the bed, means mounted on the frame and operatively connected with said brackets to move the bed toward and from the platen, and means acting to counter-balance the weight of the bed, said operating means being adjustable to vary the range of movement of the bed and including a hand lever mounted on the frame and a link connecting the bed and lever and adapted to be locked in the work-clamping position of the bed.

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