

R. S. SMITH.
DRAWING PRESS.
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1,368,366.

Patented Feb. 15, 1921.

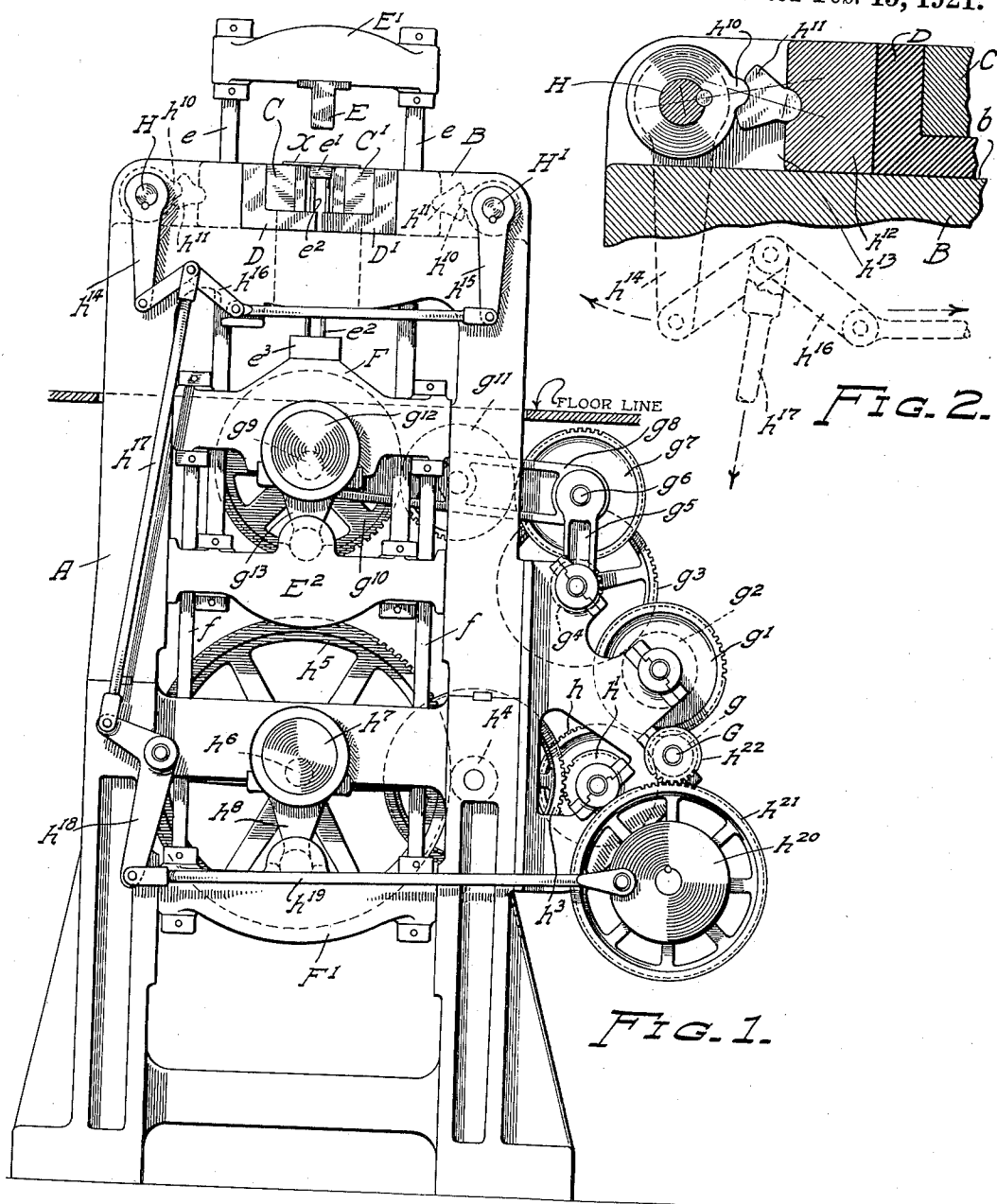


FIG. 1.

FIG. 2.

WITNESS

Phil. J. Rawn
Del.

INVENTOR
R. Stanley Smith.

BY

Erwin, Wheeler & Woolard
ATTORNEYS

UNITED STATES PATENT OFFICE.

REUBEN STANLEY SMITH, OF MILWAUKEE, WISCONSIN.

DRAWING-PRESS.

1,368,366.

Specification of Letters Patent.

Patented Feb. 15, 1921.

Original application filed July 16, 1917, Serial No. 180,758. Divided and this application filed March 8, 1920. Serial No. 363,957.

To all whom it may concern:

Be it known that I, REUBEN STANLEY SMITH, a citizen of the United States, and a resident of the city of Milwaukee, county of Milwaukee, and State of Wisconsin, have
5 invented certain new and useful Improvements in Drawing-Presses; and I do declare the following to be a full, clear, and exact description thereof, such as will enable
10 others skilled in the art to which my invention pertains to make and use the same, reference being had to the accompanying drawings for a disclosure of one construction in which the invention has been embodied.
15

The subject matter of the present application has been divided out of my prior application, Serial #180,758, filed July 16, 1917, since matured into Patent No. 1,338,335,
20 April 27, 1920, to which patent reference may be had for a disclosure of the generic aspects of my invention.

The invention relates to drawing presses which are employed for the purpose of producing shaped articles from flat metal sheets.
25 In particular, the drawing press may be used in the production of the side bars of an automobile frame, which, as is well known, are formed from sheet metal and have the
30 formation of a channel bar, but the press may be used in the production of other articles in which the margins are bent so as to stand at an angle to the plane of the web of the bar.

Without describing in detail the operation of the drawing press disclosed in the patent
35 hereinbefore referred to, it will be sufficient for the purposes of this application to say that the press is provided with an eccentric mechanism which is actuated in proper timing so as to move the punch to clamp the
40 metal plate between the punch and the knock-out plate usually employed in drawing presses, and which in my press, stands normally flush with the top of the matrix,
45 and that at or near the termination of such clamping movement, a second set of eccentrics is actuated so as to continue the movement of the punch to force the clamped plate
50 into the matrix of the press and perform the drawing operation upon the plate, whereby the desired shape is imparted to the article formed from the said plate.

The eccentric mechanisms referred to are
55 separately controlled in their action by a

timing mechanism, as disclosed in the said patent, so that the clamping action upon the metal plate is effected with rapidity of movement of the punch, which clamping action is followed immediately by the retarded operation of the eccentric mechanism which
60 imparts further movement to the punch to perform the drawing operation.

The surface of the bed of the press is formed as a smooth topped table, over which
65 the plates may be manipulated without the interference heretofore encountered in drawing presses, by reason of mounting the matrix and its adjunctive devices above the
70 plane of the bed of the press. To enable me to carry out the plan just described, I provide a longitudinal channel in the bed of the press, and in such channel I place the matrix, which, with the punch above referred to, constitute the die members of the press. In
75 drawing presses as heretofore constructed, the matrix has been fitted in a shoe, which is attached to the bed of the press. It has been required in such presses that the shoe referred to be of such proportions and
80 strength as to enable it to resist the lateral stresses encountered in the operation of the press, and also that the sole of the shoe be of sufficient thickness, together with the bed upon which the shoe is placed, to withstand
85 any tendency to fracture under the crushing strains. But in my improved press the bed in which the channel for the matrix is formed is so proportioned that all of the strains incident to the operation of the
90 presses of ordinary common construction are effectively resisted and the causes for complaint are eliminated. I achieve this result by giving the bed of the press a formation, which in cross-section resembles the letter C,
95 when partly turned, and which possesses the highest elements of rigidity.

The knock-out plate is normally sustained so as to be flush with the top of the matrix, but such knock-out plate is actuated so as to
100 retire within the matrix at a rate of speed which is coincident with the described further advancing movement of the punch, following the clamping operation, and during which further movement the drawing operation
105 upon the metal plate is performed, but the clamping relation between the punch and the knock-out plate is maintained during the drawing operation.

In presses in which the side members of 110

the matrix are immovable or fixed with relation to each other, it sometimes happens that inequalities existing in the metal sheet to be drawn, will impose very severe strains upon the structure and operating parts of the press at the time that the punch is forcing such a metal plate into the matrix. Under such conditions, compression of the metal forming the sides of the channel bar takes place between the punch and the side members of the matrix, and the resistance thus interposed sometimes results in disaster to the press.

With a view to relieving the press from the unusual strains which are exerted under the exigencies described, I have constructed the said matrix so that the side members thereof may have capacity for limited movement toward each other, such side members being actuated at or near the termination of the drawing movement of the punch. In carrying out this feature of my invention, I arrange the said side members of the matrix so as to provide a slight clearance between the matrix and the metal sheet as the punch forces the latter into the matrix, thus permitting the metal plate to be drawn without the expenditure of more than the power required to operate the press under normal conditions. Through properly positioned actuating devices, I move the side members of the matrix toward each other so as to exert a great pressure with but little consumption of power, and squeeze the flanges of the drawn bar into contact with the sides of the punch, and thus complete the formation of the said bar by giving a permanent set to said flanges. The provisions described enable me to obviate the difficulties heretofore referred to, and to complete the drawn article without the use of the excessive force incident to the operation of the older types of drawing presses.

To impart lateral movement to the side members of the matrix, I employ a crank mechanism which, with the consumption of a small amount of power, will actuate a toggle mechanism to exert the necessary degree of pressure upon the side members of the matrix and move them so as to impart the desired squeezing pressure upon the side flanges of the channel bar which has been formed from the blank in the matrix.

As in my said patent, the further movement of the punch to perform the drawing operation is transmitted through the devices which have previously brought the punch into clamping relation with the metal plate to be drawn into shape. That is to say, when the eccentric mechanism for effecting the clamping movement has completed its operation, the eccentrics for effecting the drawing operation impart a further movement to the punch by bodily moving the first or clamping eccentric mechanism.

Another feature embodied in my present invention is one wherein the main operating parts, including the gears and the several eccentric mechanisms, are located below the floor line with reference to which the press is set. An advantage which follows from this arrangement is that it enables me to construct a press which is accessible from all sides, without any interference by reason of the presence of the shafts and gears at the sides and ends of the press, as heretofore.

Another advantage resulting from the construction just referred to, is that I am enabled to maintain a constant shower of oil upon the several actuating and operating mechanisms, and so provide an efficient means for lubricating the parts. The oil which drips from the several mechanisms may be collected and filtered, and again used for lubrication.

In the drawings which accompany this specification,

Figure 1 is an end view showing in general outline the construction of press illustrated in my above mentioned application.

Fig. 2 is a sectional view through one side of the bed and matrix, showing in enlarged detail, one of the toggle mechanisms employed to impart lateral movement to the side members of the matrix, to effect the side squeezing operation described.

In the drawings, A indicates the main frame of the press, which may be integrally formed, or it may be constituted of frame sections which will be so secured together as to form a unitary structure. The base of this press will rest at the bottom of a pit of suitable dimensions, and the driving shafts and gears and eccentric mechanisms will be placed entirely below the floor line at the top of the pit, and with relation to which the press is set, so as to render the press accessible from all sides without interruption or interference. This arrangement further enables me to maintain a constant shower of oil either in the form of a spray, or in the form of streams directed upon particular parts, so as to effect an efficient lubrication of the parts, which in their operation are subject to considerable friction, by reason of the severe stresses occurring in the press. To be able to lubricate the mechanism of the press in the manner described, is advantageous in that it eliminates the labor of periodic lubrication and further protects the press against neglect in this important particular.

Surmounting the main frame, is the bed B of the press, which bed is channeled longitudinally as indicated at b, for the reception of the matrix side members C, C'. In the construction illustrated, I have shown the said matrix members as supported upon angular carriers D, D', in the angles of which the respective matrix members C, C',

rest. The combined width of the carriers D, D^1 , is a little less than the width of the channel b in the bed of the press, so that an open space is provided between their adjacent lower edges. The punch E is mounted at the under side of a cross head E^1 , which cross head is mounted upon the upper ends of straining rods e , which latter are guided in vertical openings in the bed of the press. A sliding cross head E^2 is connected to the lower ends of the straining rods e . The cross heads E^1 and E^2 , and the straining rods e , constitute a punch carrying frame, which is movable as a whole. The lower cross-head E^2 is guided in the sides of the main frame, so that the punch carrying frame may have a vertical reciprocation in a fixed path.

A second frame, composed of an upper cross head F , a lower cross head F^1 , and straining rods f , connecting the cross heads F and F^1 , is also guided for vertical reciprocation in the frame of the press, and is likewise movable as a whole. The straining rods E of the punch carrying frame pass through openings in the cross head F of the lower frame, and the straining rods f of the lower frame pass through openings in the lower cross head E^2 of the punch carrying frame. While the said frames are each capable of independent movement, they have a joint movement at times, as will be described later.

The straining rods e, e , uniting the cross-heads E^1, E^2 , as well as the straining rods f, f , uniting the cross-heads F, F^1 , are threaded at their ends for the reception of nuts, which bear upon the upper and lower sides of the respective cross-heads, so as to provide an exact adjustment of the punch E with reference to the matrix of the press, and correspondingly define the movements of the punch under the influence of the eccentrics.

The driving shaft G is journaled at one side of the frame and carries a pinion g meshing with a gear g^1 , upon the axis of which is fixed a pinion g^2 , meshing with a gear g^3 which latter carries a pinion g^4 . Upon the axis of the gear g^3 and pinion g^4 , a radial arm g^5 is mounted, the said arm supporting at its outer end a stud g^6 , upon which rotates a gear g^7 , in mesh with the pinion g^4 previously described. A floating lever g^8 is supported upon the stud g^6 , and extends to the exterior of the press. At its inner end, the floating lever supports an eccentric shaft g^9 journaled in the cross head F , of the lower frame.

Keyed upon the eccentric shaft is a gear g^{10} which meshes with an idle gear g^{11} carried by the floating lever and in mesh with the gear g^7 . Through the connections described, motion is transmitted from the driving shaft to the eccentric shaft. The

train of gears will be duplicated at the other end of the press, and connected by suitable shafting. Several eccentrics, one of which, indicated g^{12} , are mounted on the eccentric shaft g^9 , and are connected by eccentric links g^{13} , to the lower cross heads e^2 of the punch carrying frame.

The surface of the bed B is formed as a smooth topped table, free from projections. The matrix members C and C^1 , and their supporting carriers D, D^1 , lie flush with the surface of the bed. A knock-out plate e^1 is normally supported with its face flush with that of the matrix, as shown in Fig. 1. Knock-out pins e^2 , guided in vertical openings in the bed B , support the knock-out plate e^1 at their upper ends, and the lower ends of the said knock-out pins rest upon a plane surface formed upon the top of the cross head F . In such position, the knock-out pins e^2 serve as thrust rods to maintain at all times a fixed distance between the knock-out plate e^1 and the plane surface e^3 of the cross head F .

The pinion g on the driving shaft G also meshes with a gear h , on the hub of which is fixed a pinion h^1 , meshing with a gear h^3 , which carries a pinion h^4 , which in turn meshes with a gear h^5 , mounted upon an eccentric shaft h^6 , journaled in a fixed cross bar of the main frame. The eccentric shaft h^6 is provided with eccentrics h^7 , which latter are connected by links h^8 , to the cross head F^1 of the lower frame.

In the operation of the press, a metal blank x is fed into the press and properly positioned over the matrix. The speed of rotation of the eccentric shaft g^9 , is such that the eccentrics g^{12} , carried thereby, impart a comparatively quick movement to the punch carrying frame to bring the punch E into clamping relation with the blank resting upon the knock-out plate e^1 , and supported also upon the face of the matrix. This clamping relation is established as the eccentrics g^{12} reach the end of their throw. The reducing gears leading to the eccentric shaft h^6 are so proportioned that a relatively slow movement is imparted by the eccentrics h^7 to the drawing frame. Just as the eccentrics g^{12} complete their throw, the eccentrics h^7 commence their operation, and transmit a further but retarded movement to the punch carrying frame through the now distended eccentric links g^{13} , the shaft g^9 , and the lower cross bar E^2 of the punch carrying frame. During the downward stroke of the eccentrics h^7 , the punch carrying frame and the drawing frame move jointly as a single construction, whereby the punch in its further movement into the matrix under the action of the eccentrics h^7 , forces the metal blank x into the matrix, and folds the sides thereof against the sides of the punch so as to

form the said metal blank into a channel bar.

From the time that the punch has reached its position of clamping relation with the blank α and the knock-out plate e^1 , the said relation does not change until after the drawing operation has been performed. The punch E and the cross head F move at the same relative speed during the drawing operation, and the knock-out plate e^1 being sustained by the knock-out rods, the blank α is firmly clamped between the punch and the knock-out plate e^1 during the whole of the drawing operation. The advance of the punch E to force the blank into the matrix, is accompanied by the simultaneous retirement of the knock-out plate e^1 , by reason of the movement of the cross head F under the action of the eccentrics h^7 , and when the latter have passed their dead center, the withdrawal of the punch will be closely followed by the movement of the knock-out plate e^1 , to eject the channel bar from the matrix. The clamping relation between the punch and the knock-out plate is broken at the moment that the knock-out plate reaches its normal elevated position in line with the face of the bed, and the punch is raised to its highest position by reason of the eccentrics g^{12} having passed their dead center on their longer throw, and through their connected straps g^{13} are acting to lift the punch carrying frame.

In drawing presses as usually constructed heretofore, a single set of eccentrics or crank mechanism has been used to impart both clamping movement and the drawing movement to the punch. In such older mechanism, the punch effects its clamping engagement with the metal blank at a time of comparatively rapid movement of the punch, with the result that the punch forces the metal blank into the matrix with a sudden blow, which occurs with such force and rapidity that time is not allowed for the necessary molecular changes in the structure of the metal to take place, and this frequently is productive of an uneven or unequal distortion which weakens the bar along the line of the bend. But in my approved press, the compound motion which I employ enables me to effect the clamping action upon the blank with rapidity, and to instantly start the drawing operation at its lowest relative speed. The result of the operation of my press is that at the commencement of the drawing operation, the molecular construction of the metal blank has an opportunity to adjust itself to the change, so that the drawing operation may be performed upon the blank and so obviate the liability to the damage heretofore usually incurred.

As indicated at the beginning of this

specification, it sometimes happens that inequalities in the metal blanks impose severe strains upon the construction of the press when the punch starts to force the blank into the matrix. Such contingencies require the expenditure of more than the power required to operate the press under normal conditions, and disaster to the press sometimes results. I have found that by constructing the press so that the side members of the matrix are disposed at a distance from the punch a little in excess of the thickness of the blank to be drawn, that the punch may force the metal blank into the matrix with no unusual effort, and that by providing means for taking up the clearance by constructing the side members of the matrix with capacity for movement toward each other, the sides of the drawn bar may be squeezed against the sides of the punch, to complete the formation of such bar.

To enable me to perform this operation of exerting a side pressure on the flanges of the channel bar, I have mounted a pair of longitudinal shafts H, H^1 , in the bed of the press, and have fixed upon the said shafts a series of cams or toggle members h^{10} , which are adapted upon the partial rotation of the said shafts, to impart their thrust to other toggle members h^{11} , which bear against sliding blocks h^{12} mounted in channels h^{13} in the bed of the press. The sliding blocks h^{12} abut directly against the matrix members C and C^1 , or against the carriers D and D^1 , in case the latter are employed to support the matrix members.

The parts described are operated for the purpose stated, at the conclusion of the drawing movement of the punch, and act to compress the flanges of the channel bar between the punch and the matrix members, whereby a permanent set is given to the said flanges. This squeezing motion is followed by a quick relaxation of the pressure, and leaves the withdrawal of the punch and the ejection of the channel bar from the matrix to be performed freely, and without having to overcome the frictional resistance existing between the punch, the blank and the matrix in drawing presses of the older type.

I have provided a simple means for effecting the lateral movement of the matrix members just described. The rock shafts H and H^1 , are provided with radial levers h^{14} and h^{15} connected at their ends by a toggle h^{16} , which latter is operated by a link h^{17} connected at its other end to one arm of a bell crank lever h^{18} , the other arm of which is connected by means of a rod h^{19} to a crank h^{20} mounted axially with a gear h^{21} driven by a pinion h^{22} , fixed on the driving shaft G before referred to.

It will be observed that the bed of the press has in cross-section the general outline of a letter C, turned 90° on its axis.

The proportions embodied in the formation of the bed of the press are such that the opposing strains are resisted much more effectively than in the common types of similar presses, in which the matrix is set in a shoe which is mounted upon the bed of the press, and over which the work must be lifted.

Having thus described my invention, what I claim and desire to secure by Letters Patent of the United States, is:

1. In a drawing press, the combination with a set of cooperative work shaping members, of crank motion mechanism adapted to effect a relative approach of said members for one operation, and separately acting crank motion mechanism adapted to impart a further movement of said members in the same direction for a second operation, one of said members being formed in laterally movable sections, and means for imparting relative movement of said sections toward each other subsequent to the approaching movements of said members.

2. In a drawing press, the combination with a matrix provided with laterally movable side walls, a knock out plate normally supported between the upper margins of said side walls, a punch motion mechanism adapted to actuate said punch into work clamping position with reference to the knock out plate, separately acting crank motion mechanism for additionally actuating said punch and also the knock out plate toward the base of the matrix for a work shaping operation, means for subsequently moving said matrix walls toward each other to press the work upon the sides of said punch, and means for retracting said side walls and subsequently retracting the punch and the knock out plate to their initial positions.

3. In a drawing press, the combination with a matrix provided with laterally movable side walls, a knock out plate normally supported between the upper margins of said side walls, a punch, crank motion mechanism adapted to actuate said punch into work clamping position with reference to the knock out plate, separately acting crank motion mechanism for additionally actuating said punch and also the knock out plate toward the base of the matrix for a work shaping operation, toggle mechanism for subsequently moving said matrix walls toward each other to press the work upon the sides of said punch, and means for retracting said side walls and subsequently retracting the punch and the knock out plate to their initial positions.

4. In a drawing press, the combination with a matrix provided with laterally movable side walls, a knock out plate normally supported between the upper margins of said side walls, a punch, crank motion mechanism adapted to actuate said punch into

work clamping position with reference to the knock out plate, separately acting crank motion mechanism for additionally actuating said punch and also the knock out plate toward the base of the matrix for a work shaping operation, toggle mechanism for subsequently moving said matrix walls toward each other to press the work upon the sides of said punch, means for retracting said side walls and subsequently retracting the punch and the knock out plate to their initial positions, and means for automatically initiating the work clamping, work shaping, pressing, and retracting operations in sequence.

5. In a metal working press, a frame supporting a fixed bed at the top thereof and extending below the floor line above which the bed is located, a head reciprocating over the bed, straining rods connected to the head and guided for vertical movement by the bed, a driving shaft with eccentric connections to the straining rods to actuate the said head, said shaft and connections being supported in the frame below the floor line, so as to afford unobstructed access to the press from all sides, and enable the actuating mechanism to be lubricated by an oil spray.

6. In a drawing press, a reciprocating punch, a fixed bed having a channel in which the matrix is set to form a flush-top work table, movable sides for the matrix, and devices within the bed for actuating the said movable sides, to supplement the punch and matrix in shaping the work.

7. In a drawing press, the combination with a relatively stationary divided matrix having side walls adapted to approach and recede from each other, a punch, means for actuating the punch into the matrix for a work shaping operation, and means for actuating the side walls of the matrix toward each other upon completion of the work shaping operations of the punch.

8. In a drawing press, the combination with a relatively stationary divided matrix having side walls adapted to approach and recede from each other, a punch, means for actuating the punch into the matrix for a work shaping operation, and means for actuating the side walls of the matrix toward each other upon completion of the work shaping operation of the punch, said side walls being held in a relatively fixed position during the work shaping operation of the punch.

9. In a drawing press, the combination with a relatively stationary matrix having laterally movable side walls, a movable punch, means for holding the side walls in a fixed position during the movement of the punch into the matrix, and means for actuating said side walls toward each other upon completion of the punch movement.

10. In a drawing press, the combination of a set of cooperating work shaping members, mechanism adapted to effect a relative approach of said members for one operation, separately acting mechanism adapted to produce a further relative movement of said members for a second operation, one of said members being formed in laterally movable sections, and means for moving said sections toward each other upon the completion of the said second movement of the work shaping members.

11. In a press for drawing metal plates into shape, a frame, a punch and a matrix, a bed forming a work table supported on the top of the frame, means comprising gears and eccentrics for actuating the punch arranged and connected thereto below the floor line with reference to which the press is located, whereby the bed is rendered accessible from all sides without obstruction by said actuating means, and whereby such actuating means may be constantly lubricated by an oil spray.

12. A press for drawing metal blanks into shape, comprising a frame, a bed positioned at the top of the frame above the

floor line with reference to which the press is set, a punch working over the bed, a punch carrying frame guided by the bed and extending below the floor line, and actuating mechanism for vertically moving the punch carrying frame, said mechanism being positioned below the said floor line, whereby the bed of the press is accessible at all sides and lubrication of the punch actuating mechanism may be effected by an oil spray.

13. In a drawing press, a punch, a fixed bed having a channel in which the matrix is set to form a smooth topped table over which the work may be moved, said matrix composed of movable side members, and means for actuating the matrix members to supplement the action of the punch in shaping the work.

In testimony whereof, I have signed my name at Milwaukee, this 3d day of March, 1920.

R. STANLEY SMITH.

Witnesses:

W. F. WOOLARD,
C. THEO. OSTERBERG.