R. S. SMITH.

HORIZONTAL PIERCING PRESS.

APPLICATION FILED APR. 7, 1919. RENEWED SEPT. 24, 1920.

1,357,358. **Patented Nov. 2, 1920.**

4 SHEETS—SHEET 1.

Fig. 1.

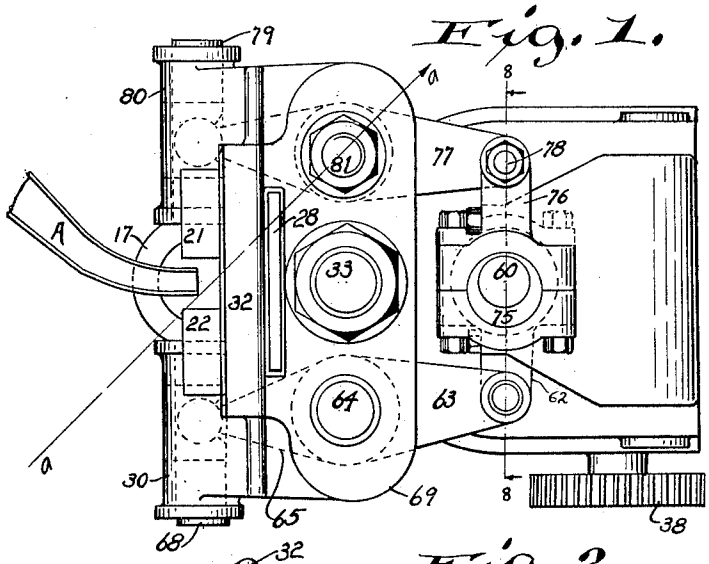
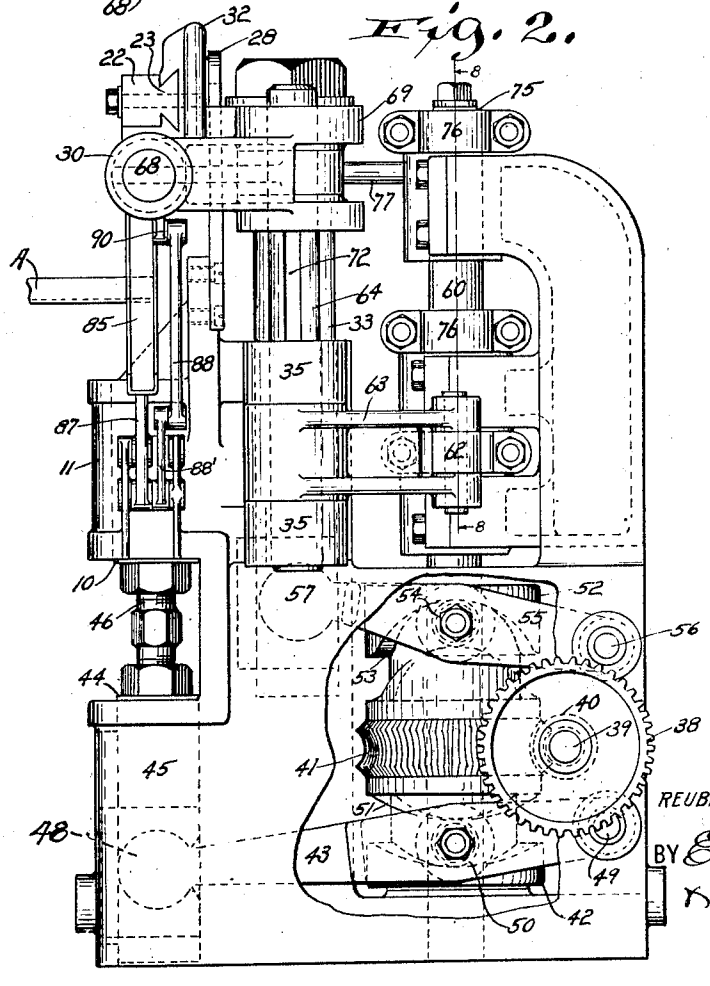


Fig. 2.



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4 SHEETS—SHEET 2.

Fig. 3.

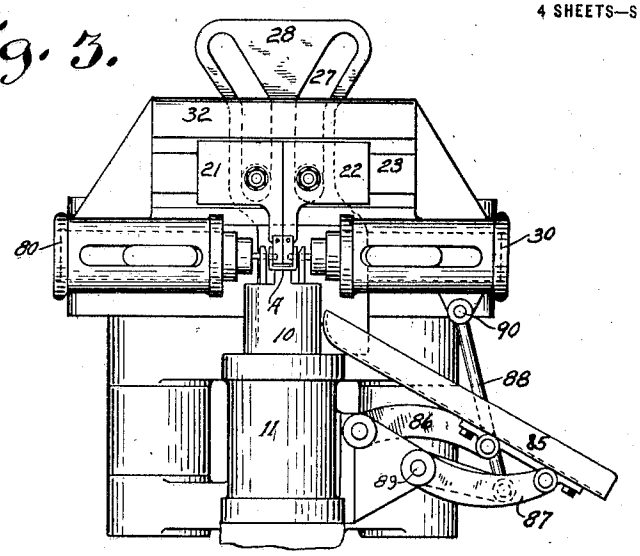
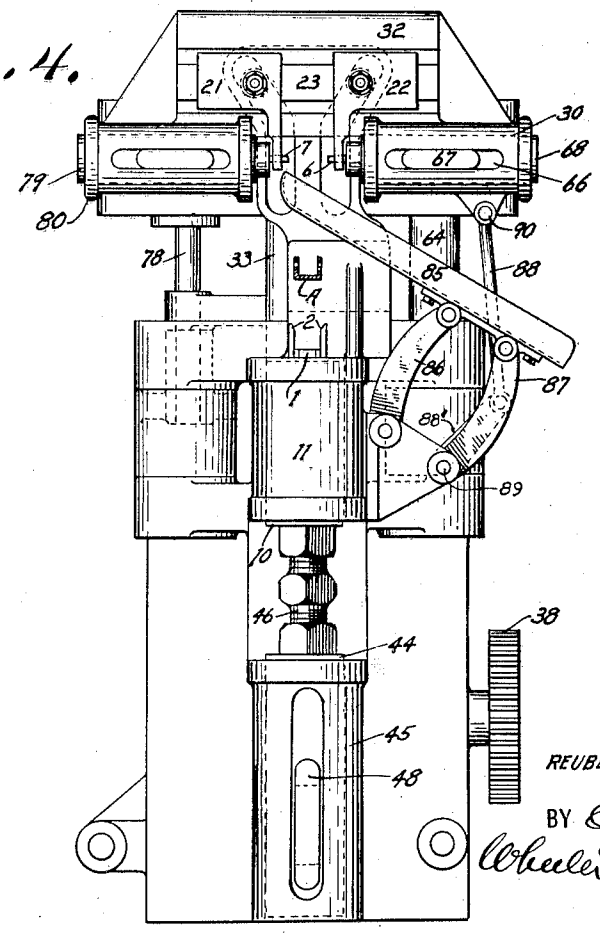


Fig. 4.



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4 SHEETS—SHEET 3.

Fig. 5.

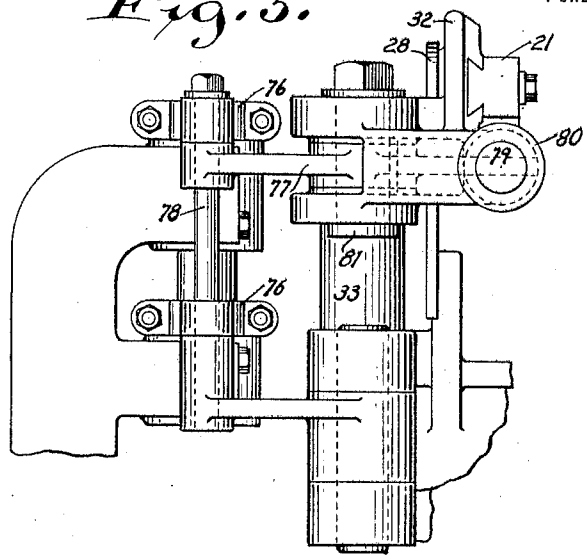


Fig. 6.

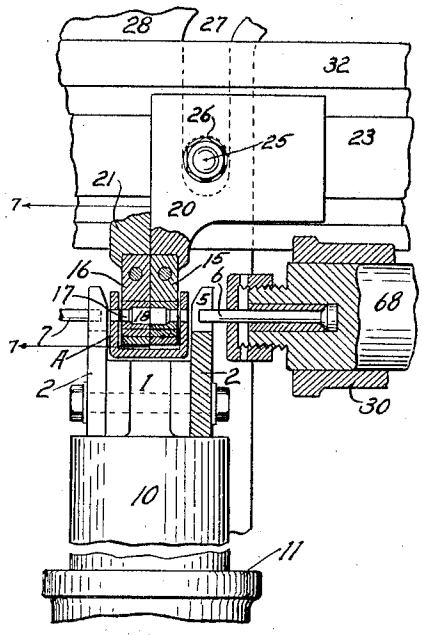
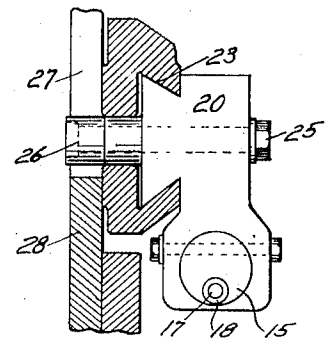


Fig. 7.



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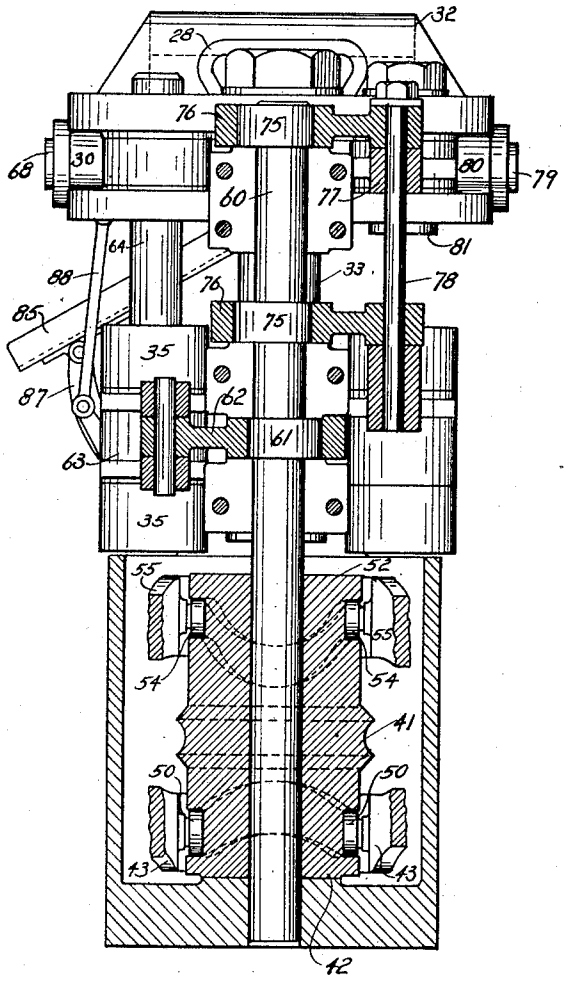
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4 SHEETS—SHEET 4.

Fig. 8



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UNITED STATES PATENT OFFICE.

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HORIZONTAL-PIERCING PRESS.

1,357,358. Specification of Letters Patent. Patented Nov. 2, 1920.

Application filed April 7, 1919, Serial No. 288,086. Renewed September 24, 1920. Serial No. 412,623.

To all whom it may concern:

Be it known that I, REUBEN STANLEY SMITH, a citizen of the United States, residing in the city of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a certain new and useful Improvement in Horizontal-Piercing Presses, and do hereby declare that the following is a full, clear, and exact description thereof, such as will enable persons skilled in the art to which the invention pertains to make and use the same, reference being had to the drawings hereto attached for disclosure as to certain details of construction and arrangement.

The machine embodying this my present invention is designed to form an element of the assemblage of machines disclosed in my pending application Serial No. 212,934, filed Jan. 21, 1918, such assemblage including machines which by their related and successive operations, punch from metal sheets the side and cross bar and other blanks used in constructing an automobile or other vehicle frame, shape such blanks according to the particular requirements appertaining to each, perform the necessary milling operations thereon, assemble the several constituent parts, and secure all of such parts in their respective positions, so that in a continuous operation of mechanical devices a completed automobile or other vehicle frame is automatically produced.

My invention relates to improvements in piercing presses.

The object of my invention is to provide an improved form of press designed particularly for piercing the flanges of channel bars and other bars or plates having members or flanges lying in intersecting planes, where the form or shape of the bar makes it desirable that the punches be operated horizontally.

In piercing holes through the side flanges of a channel bar, it is desirable that both flanges be simultaneously pierced from opposite sides, not only for the purpose of expediting the operation, but also in order that the pressure upon the bar may be balanced. To accomplish this, I employ a die adapted to fit between the flanges of the channel bar, and I provide means for manipulating this die into and out of position, whereby it may be inserted between the flanges preparatory to a piercing operation and then removed after the piercing operation has been completed, and after the retraction of the punches.

I have discovered that, by providing a die formed in two separable parts and employing means for separating the parts when the die is removed from between the flanges, I am able to effect a discharge of the punchings from an interior cavity in the die. Therefore, it is a part of my object to provide a divided die having a central cavity to receive the punchings and to also provide means for not only mechanically moving this die into and out of position with reference to the work, but also automatically separating the die members, when removed from the work, whereby the punchings may be discharged from the cavity after each punching operation.

A further object of my invention is to provide mechanical means for not only removing the die from the work, but for also moving the punches and work supporting parts of the machine out of the path of the work after each punching operation, whereby the work may be mechanically conveyed into and out of position for piercing operations, my invention being ancillary to a more general plan in which I have in view the mounting of the bars to be pierced upon an endless conveyer to which the bars may be clamped in spaced relation to each other, advanced in step by step movements and presented to the piercing machine successively for piercing operations. Therefore, in order to facilitate presenting of the bars successively into position for piercing, I have designed a vertically movable bar supporting rest and means for mechanically actuating it upwardly into bar supporting position preparatory to a piercing operation, in connection with means for simultaneously moving the piercing punches and the die downwardly into position for a piercing operation, after the conveyer has carried the bar to a position where it will be received within or upon the rest, and where it will receive the die when the latter and the punches are again moved into working position.

It is my purpose also to provide means whereby, when the die is removed from the work and its members separated to permit a discharge of the punchings, these punchings will be conveyed to a suitable point of discharge, whereby they will be prevented from damaging the working parts or in-

terfering in any way with the operation of the machine.

In the drawings—

Figure 1 is a plan view of a machine embodying my invention.

Fig. 2 is a side elevation of the same.

Fig. 3 is a front elevation of the upper portion of the machine showing the parts as they appear upon completion of a punching operation and preparatory to the retraction of the movable members.

Fig. 4 is a front elevation showing the movable members of the press in retracted positions and also showing the chute in the raised position in which it receives the punchings or slugs when the die is opened by a separation of its members.

Fig. 5 is a fragmentary view of the upper portion of the machine as seen from the opposite side from that illustrated in Fig. 2.

Fig. 6 is a fragmentary view, partly in front elevation and partly in vertical section, drawn to a plane which includes the axes of the punches and the die cavity.

Fig. 7 is a fragmentary sectional view drawn on line 7—7 of Fig. 6.

Fig. 8 is a sectional view drawn on line 8—8 of Figs. 1 and 2.

Like parts are identified by the same reference characters throughout the several views.

The machine illustrated is designed for piercing the side flanges of channel bars employed in the construction of motor driven vehicle frames. In Figs. 1 and 2, I have illustrated a fragment of the front end of a side bar A of an automobile frame, the bar A being presented to the machine in position for a piercing operation upon its side flanges at a short distance from its front end. The line of movement of the bar, along which it travels into position for piercing operation, and out of such position after the piercing operation has been completed, is indicated by the broken arrow line *a*—*a* in Fig. 1. The machine is so constructed as to allow clearance for the bar A in traveling along said line when the punches, die, and supporting rest are retracted. The bar A is also illustrated in cross section in Figs. 3, 4, and 6, in order that its relation to the working parts of the machine in their various positions, may be more readily understood.

The bar A will be assumed to be supported independently of the machine herein described, but in order that the extremity to be pierced may be rigidly held and kept from springing out of place during a piercing operation, I preferably provide a suitable work holder, comprising a rest 1 having upwardly projecting side walls 2 adapted to receive the extremity of the side bar between them and having notches or slots 5 in their upper margins through which the punches 6 and 7 may pass, as best shown in Fig. 6. The work holder 1 is mounted upon a mechanically actuated plunger 10 adapted to slide vertically in a suitable guide sleeve 11, whereby the holder may be retracted while the work A is being moved into position for a piercing operation, after which plunger 10 may be moved vertically to lift the rest 1 into contact with the under surface of the work, the latter being received between the side flanges, or walls 2, whereby the work is supported from below and from each side. This movement of the work supporting rest will preferably be derived from the same source of power as that which actuates the punches 6 and 7 and other movable parts of the press, as hereinafter explained.

Simultaneously with the upward movement of the work holder, a die moves downwardly between the side flanges of the bar A directly above the rest 1. This die is composed of a pair of separable members 15 and 16, each provided with an aperture 17 to receive one of the punches 6 or 7. These apertures are enlarged interiorly, thereby forming a cavity 18. These members 15 and 16 are connected with slides 20 and 21 adapted to support the die members 15 and 16 from a transversely extending dove-tailed guide bar 23. Each of the slides 20, 21 is provided with a stud 25 which carries a roller 26 adapted to travel in a slot 27 formed in a frame bracket 28.

The guide bar 23 is vertically movable, as hereinafter explained, and the upper end portions of the slots 27 extend obliquely from the lower or vertical portions of the slots and also divergently. Therefore bracket 28 being fixed on the machine frame, it is obvious that, when guide bar 23 is moved vertically, slides 20 and the die members will also move vertically while the rollers 26 are traversing the vertical portions of the slots 27. But when the rollers 26 enter the oblique upper portions of the slots 27, the slides 20 and 21 will separate and the continued upward movement of guide bar 23 will then not only carry these slides and the die members upwardly, but will also cause them to move laterally to the positions in which they are shown in Fig. 4, thus permitting a delivery of the slugs or punchings from the die cavity 18. The downward movement of the guide bar 23 will, of course, carry the slides 20 and 21 inwardly and downwardly until their inner margins meet, whereupon the die members 15 and 16 will again be brought into abutting contact and the rollers 26 will then travel downwardly in the vertical lower portions of the slots 27 to the positions in which they are shown in Figs. 3 and 6, the die members being thus restored to working position.

The punch supporting sleeves 30 and 80 and the guide bar 23 may be mounted upon

a vertically movable head 32 carried by a post 33 which slides vertically in suitable bearings 35 in the machine frame. The vertical movement of this head will take place only when the punches 6 and 7 are retracted from the work. When so retracted, the head may be raised to the Fig. 4 position, or it may be depressed from such position to the Fig. 6 position. When raised to the Fig. 4 position, the punches will be at a suitable distance above the work and the die members will be separated, the punches being received in the apertures 17 of the die members, since the vertical movement of the head lifts both the punches and the die members to the same extent, the only independent movement of either of these parts being the lateral or separating movement of the die members heretofore explained.

In order that the vertical movements of the work supporting rest, the die members, and the punches may take place simultaneously, and in order that the punches may be actuated for punching operations after the die members and the punches have been adjusted in working position, I preferably provide means for developing all of these movements from a common source of power. In the construction illustrated, motion is transmitted to the work supporting rest 1 from a driving gear wheel 38, through shaft 39, worm 40, worm wheel 41, cam 42, lever 43, and plunger 44, the latter being mounted to slide in frame sleeve 45 and connected by an adjustable rod 46 with the plunger 10. Frame sleeve 45 and also the plunger 44 are slotted to receive a rounded head 48 on the extremity of lever 43. Lever 43 is pivoted to the frame at 49 and is provided with a roller 50 adapted to travel in cam groove 51. Cam 42 may be directly connected with one side of worm wheel 41.

Worm wheel 41 is provided, on its upper side, with another cam 52, having a cam groove at 53 in which a roller 54, carried by lever 55, may travel. Lever 55 is pivoted to the frame at 56 and has a rounded head 57 engaged in a slot or bearing recess formed in the lower end of post 33. Therefore motion may also be transmitted from worm wheel 41 through lever 55 to the post 33 and head 32, whereby the movements of the die members and the vertical movements of the punches, as above explained, may be derived.

It will be observed that the shaft 60 which carries worm wheel 41 and the cams 42 and 52 respectively, is extended vertically and this shaft is utilized to actuate the punches for punching operations. The motion of shaft 60 is transmitted to the punch 6 through eccentric 61, connecting member 62, arm 63, vertically disposed rock shaft 64, and arm 65, the latter extending through a slot 66 in the sleeve 30 and having a rounded head 67 engaged in a slotted bearing in the punch actuating plunger or slide bar 68 which is mounted to slide in said sleeve 30. Arm 65 is in sliding key connection with rock shaft 64, the latter having a splined groove 72. This arm 65 is supported from the head 32 by bracket 69, whereby this arm 65 may be moved vertically in correspondence with the vertical movement of the head 32 and the punches without being disengaged from its actuating shaft 64.

Similarly, motion is transmitted from shaft 60 to punch 7 through a pair of eccentrics 75, connecting members 76, and lever 77, both connecting members 76 being secured to lever 77 by vertical rod 78. The working end of lever 77 is engaged in slotted bearings formed in the plunger 79 which operates within guide sleeve 80 and carries the punch 7 at its inner end. Lever 77 is fulcrumed to the head 32 by a fulcrum pin 81 corresponding in position to shaft 64, but preferably not extending downwardly below the head 32, in order that there may be clearance for the frame bar A, which, after being punched, will move along a path indicated by the dotted line *a*—*a*, Fig. 1, whereby its extremity is carried underneath this pivot pin 81.

When the die is lifted, as above explained, and its members separated, as indicated in Fig. 4, its interior cavity 18 will, of course, be exposed and the contents, *i. e.*, the slugs, permitted to fall out. The slugs will, in fact, be forced out by the punches, since the lateral or separating movement of the die members carries them upon the punches, the latter projecting entirely through the die members, as clearly shown in Fig. 4. The slugs drop into a chute 85, down which they are permitted to slide to a suitable point of discharge at the side of the machine. This chute 85 may be supported from the machine frame by a pair of links 86 and 87 having their respective ends pivotally connected with the slide and with the frame respectively. The link 87 is connected with the head 32 by a rod 88, the lower end of which is pivoted to the free end of a short arm 88′, on the rock shaft 89, to which the link 87 is fixed. The upper end may be pivoted to a depending ear 90 carried by the sleeve 30, the latter forming part of the head 32. The arrangement is such that, when head 32 is raised, link 87 will be lifted to move the chute 85 from the depressed position which it occupies in Fig. 3 to the position which it occupies in Fig. 4. The chute will be raised sufficiently to receive the punchings when the die members are separated, as above explained, but owing to the fact that the work travels along the diagonal line *a*—*a* indicated in Fig. 1, the chute may be held in this raised position while the pierced frame bar is being removed along said line, and another frame bar sub-

stituted for a piercing operation. After the unpierced frame bar has been substituted, the downward movement of head 32 will allow the chute 85 to drop to the retracted position in which it is illustrated in Fig. 3, in which position it will be out of the way of all of the other movable parts.

Briefly reviewing the operation of the machine, it will be understood that, when the parts are in the position in which they are illustrated in Figs. 2 and 4, a rotary movement of the driving gear wheel 38 will first transmit motion through the worm shaft, gearing, cams, and levers 43 and 55 respectively to raise the work supporting rest 1 and depress head 32. The depression of head 32 will cause the die members to move inwardly and downwardly, these members first moving obliquely into abutting contact and then descending into working position between the side flanges of the frame bar A. Simultaneously, the punches 6 and 7 will move down vertically to the Fig. 6 position, but in all stages of their movement will remain in alinement with the punch receiving apertures 17 in the die members. The cam grooves 51 and 53 are so formed that the work holder and head 32 will then be held at the limit of their movement of approach, (*i. e.*, with the work holder in engagement with the bar A and the die and punches in working position), until the continued rotation of cam shaft 60 has caused eccentrics 61 and 75 to transmit motion to the punches 6 and 7 for a punching operation, including a retraction of the punches after such operation has been performed. Thereupon, levers 43 and 55 will be actuated in the opposite direction until the parts are restored to the Fig. 4 position.

I claim—

1. A piercing press, including the combination of a head, means for raising and lowering said head, a set of transversely movable punches supported from the head, a die member also supported from the head in an intermediate position, and means for opening the die member when the head is in a raised position.

2. A piercing press, including the combination of a head, means for raising and lowering the head, a set of transversely movable punches supported from said head, an intermediate die supported from the head and composed of separable members, and means for separating the die members when the head is raised.

3. A piercing press, including the combination of a head, means for raising and lowering the head, a set of transversely movable punches supported from said head, an intermediate die supported from the head and composed of a pair of members each apertured to receive one of the punches, and separable laterally, means for separating said members when the head is raised, and means for holding said members in abutting contact when the head is lowered.

4. A piercing press, including the combination with a die having a central slug receiving cavity, and formed in separable sections on a plane intersecting said cavity, means for raising and lowering the die, means for separating the die sections when in one position, and means for holding said sections in abutting contact when the die is in the other position.

5. A piercing press, including the combination with a die member having a punch receiving aperture, of a punch adapted to be moved into and out of said aperture for punching operations, and means for moving the die member and punch into and out of position in the intervals between punching operations, to facilitate movement of the work into and out of position for punching operations.

6. A piercing press having a die member provided with a punch receiving aperture, in combination with a punch adapted to be moved into and out of said aperture for punching operations, of means for moving the die member and punch into and out of position in the intervals between punching operations, a work holding rest, and means for also moving the work holding rest upwardly and downwardly in the intervals between the punching operations.

7. A piercing press having a die member provided with a punch receiving aperture, in combination with a punch adapted to be moved into and out of said aperture for punching operations, of means for moving the die member and punch into and out of position in the intervals between punching operations, and means for discharging slugs from the die member when the latter is raised.

8. A piercing press having a die member provided with a punch receiving aperture in combination with a punch adapted to be moved into and out of said aperture for punching operations, of means for moving the die member and punch into and out of position in the intervals between punching operations, means for discharging slugs from the die member when the latter is raised, a slug receiver, means for adjusting the slug receiver into position to receive the slugs when discharged from the die, and means for retracting the receiver when the die and punch are restored to working position.

9. A press, including a vertically movable head, a set of punches carried thereby, a die formed in separable parts, each apertured to receive one of the punches and also carried by the head, means for actuating the punches in the die when the head is in one position, and means for actuating the

parts of the die upon the punches when the head is out of such position.

10. A press, including a vertically movable head, a set of punches carried thereby, a die formed in separable parts, each apertured to receive one of the punches and also carried by the head, means for actuating the punches in the die when the head is in one position, means for actuating the parts of the die upon the punches when the head is out of such position, a slug receiving member movable into and out of position underneath the die member, and means for actuating the same in synchronism with the movements of the head.

11. A piercing press, including the combination with a supporting frame, of a set of horizontally movable punches supported from the frame in a horizontally offset position, an intermediate die member also supported from the frame, means for moving the work along a line occupied by the die member and punches when in working position, and means for retracting the die member and punches preparatory to moving the work into and out of position for punching operations.

12. A piercing press, including the combination with a supporting frame, of a set of horizontally movable punches supported from the frame in a horizontally offset position, an intermediate die member also supported from the frame, means for moving the work along a line occupied by the die member and punches when in working position, and means for retracting the die member and removing the slugs and punches preparatory to moving the work into and out of position for punching operations.

13. A piercing press, including the combination with a supporting frame, of a set of horizontally movable punches supported from the frame in a horizontally offset position, an intermediate die member also supported from the frame, means for moving the work along a line occupied by the die member and punches when in working position, means for retracting the die member and punches preparatory to moving the work into and out of position for punching operations, and means for automatically opening the die member when out of working position, to facilitate a discharge of the slugs.

14. A piercing press, including the combination with a supporting frame, of a set of horizontally movable punches supported from the frame in a horizontally offset position, an intermediate die member also supported from the frame, means for moving the work along a line occupied by the die member and punches when in working position, means for retracting the die member and punches preparatory to moving the work into and out of position for punching operations, means for automatically opening the die member when out of working position, to facilitate a discharge of the slugs, a slug receiver, and means for automatically moving the latter into slug receiving position, during the slug discharging interval, and subsequently retracting it preparatory to the return of the die member into position for punching operations.

15. In a piercing press for punching holes in the opposite flanges of a channel bar, two punches moving simultaneously toward each other, and means for so moving them, in combination with a separable hollow die, means to move the latter into and out from the channel of the bar, and means to separate the members of the die to discharge the slugs.

In testimony whereof I have signed my name at Milwaukee, Wisconsin, this 5th day of April, 1919.

R. STANLEY SMITH.

Witnesses:
W. F. WOOLARD,
R. J. MCKERIHAN.