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POWER STOP DEVICE FOR POWER PRESSES

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2 Sheets-Sheet 1

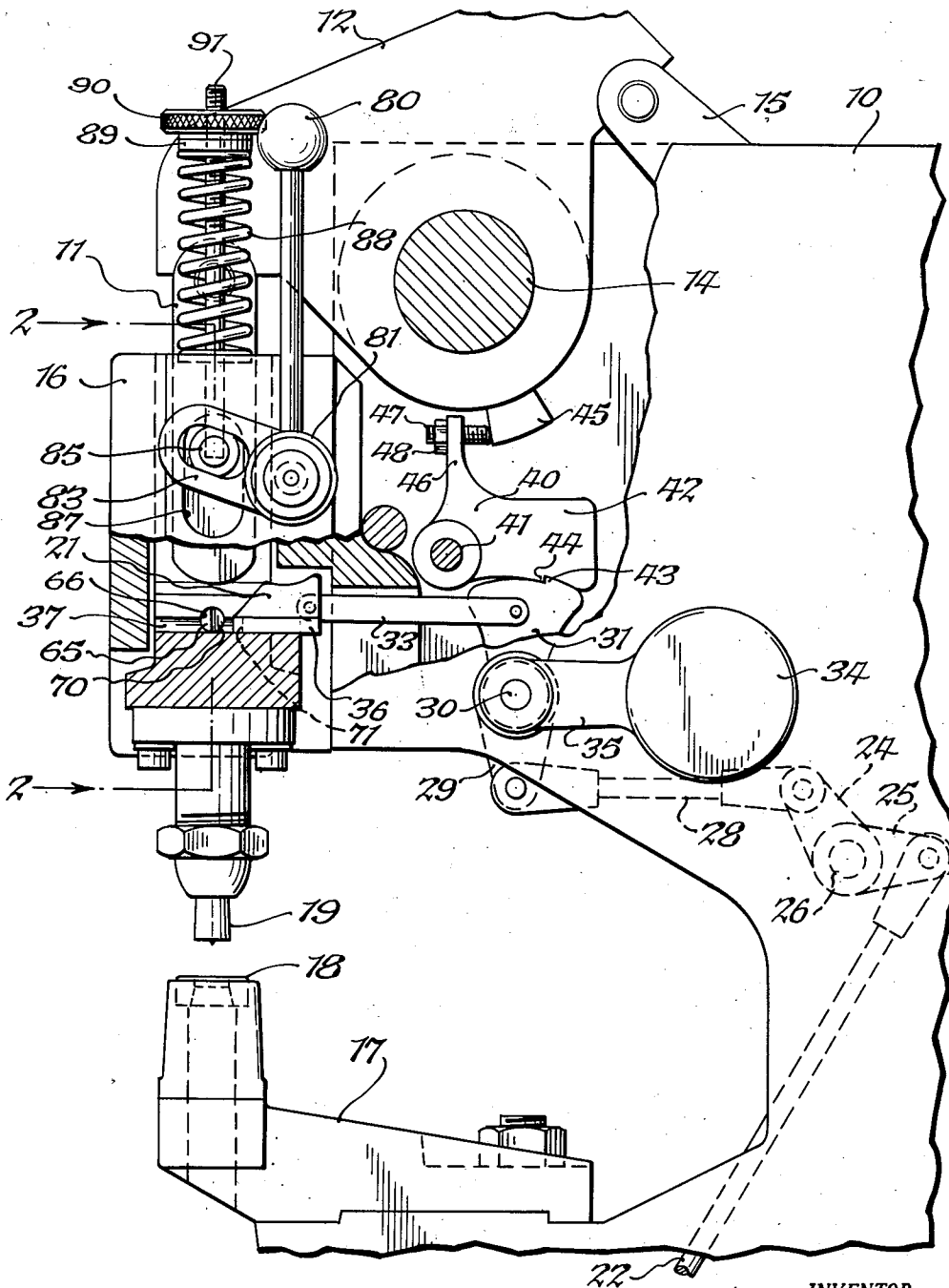


Fig. 1.

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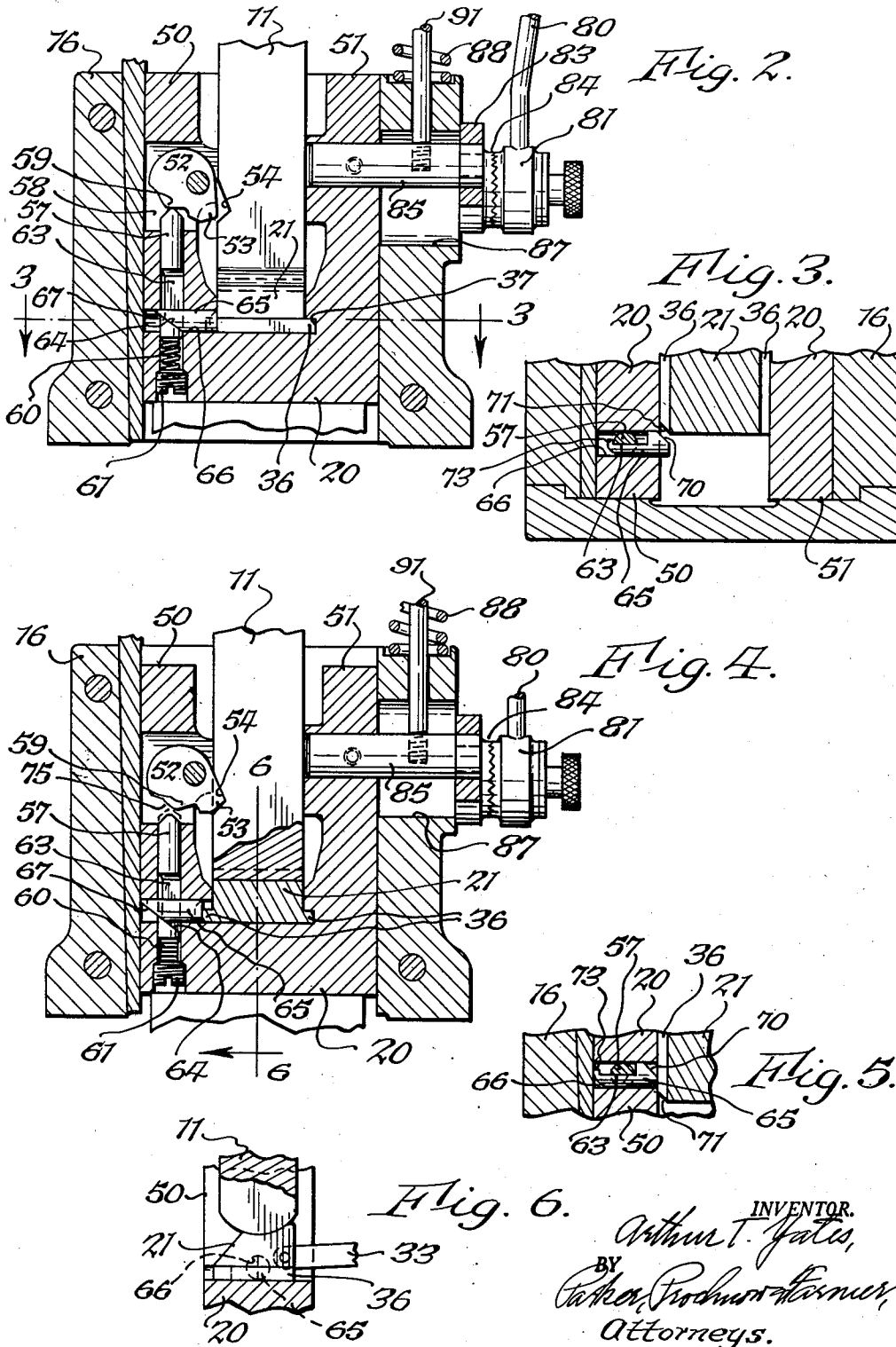
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POWER STOP DEVICE FOR POWER PRESSES

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6 Claims. (Cl. 164—104)

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This invention relates to improvements in a power stop device for power presses of the general type disclosed in my Patent No. 2,062,692 of December 1, 1936, and which may be used for punching, shearing, forging and similar operations.

In power presses of this type, a block is provided which is movable into an operative position between the tool carrying member or plunger and a ram or reciprocating member when it is desired to force a tool into engagement with the work. It has been found desirable to place this block into its operative position only when the ram is near the end of its upward movement, or movement away from the work.

One of the objects of this invention, consequently, is to provide means for accomplishing this purpose. It is also an object of this invention to provide a stop member which prevents movement of the block into its operative position, and which is moved out of its stopping position when the ram approaches the end of its movement away from the work.

It has also been found in presses of this type, that when the work is of a nature which is difficult for the tool to punch or cut, the sudden release of pressure on the tool due to its passing through the work, results in a downward force on the tool and the plunger on which the tool is mounted. This force produces serious strains on parts of the press and a resulting objectionable noise, and if the plunger is not properly connected with the ram which actuates the same and which restores the plunger to its upper position, this connection is very apt to be damaged.

Consequently, another object of this invention is to provide a construction which will ensure a secure connection between the plunger and the ram before the tool has penetrated the work, so that the forces resulting from the tool passing through the work will be transmitted directly to the ram without damage to the connection. A further object of this invention is to provide a construction by means of which a dog or pawl which forms a connection between the plunger and the ram for enabling the ram to lift the tool from the work, is released for engagement with the ram before the ram begins its downward movement to force the tool through the work. It is also an object to release the pawl for engagement with the ram by means of the block, when the block moves into its operative position. A further object is to provide an improved construction for holding the pawl out of engagement with the ram, and for moving the pawl clear of the ram when the pawl has disengaged the ram.

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A further object is to provide a press of this type in which the tool carrying member or plunger is so constructed that the tool may readily be adjusted toward the work before the ram actuates the plunger, and in which the plunger, when thus adjusted, cannot be raised by the ram; also to provide a power press which may be used with tools differing materially in length; also to provide a press of this type with a plunger or tool carrying member which can readily be adjusted to float freely in its guide regardless of the weight of the tool mounted thereon; also to provide means of improved construction for limiting the downward movement of the plunger in case the pawl fails to connect the plunger with the ram.

Other objects and advantages will be apparent from the following description of one embodiment of the invention and the novel features will be particularly pointed out hereinafter in connection with the appended claims.

In the accompanying drawings:

Fig. 1 is a side elevation, partly in section, of a portion of a power press embodying this invention.

Fig. 2 is a fragmentary sectional elevation thereof, on line 2—2, Fig. 1.

Fig. 3 is a fragmentary sectional plan view thereof, on line 3—3, Fig. 2.

Fig. 4 is a fragmentary sectional elevation thereof similar to Fig. 2, but showing the parts in different positions.

Fig. 5 is a fragmentary sectional elevation thereof similar to that shown in Fig. 3, but showing the parts in different positions.

Fig. 6 is a fragmentary sectional elevation thereof, on line 6—6, Fig. 4.

In Fig. 1, 10 represents the frame of the press, which in the particular construction shown by way of example, comprises a pair of plates arranged substantially parallel to each other, and on which the parts of the mechanism are mounted. 11 represents the ram of the press which in the construction shown is arranged to move substantially vertically in any suitable or desired manner. This ram or movable member is pivoted on one arm of a lever 12 fulcrumed in a bearing 14 on the frame 10 of the machine. The other arm of this lever is pivotally connected to a link 15, which may be reciprocated in any desired manner to impart oscillatory motion to the lever 12. The other end of the link 15 may, for example, be formed to cooperate with an eccentric (not shown) in a manner similar to that shown in said Patent No. 2,062,692.

The frame of the machine may have a suitable

tool support 17 mounted thereon on which a die or other suitable tool 18 may be secured in fixed relation to the machine and 19 represents a punch or other movable tool arranged to cooperate with the stationary die 18. These tools may be replaced by tools of other types. The punch or tool 19 may be secured in any suitable or usual manner to a plunger 20, which is vertically movable in a stationary head or plunger guide 16 rigidly secured on the frame of the machine. During the operation of the machine, the plunger 20 is normally disconnected from the ram 11 except when a block 21 is moved into operative position by the operator between a part of the plunger and the lower end of the ram. This movement of the block may be effected through any suitable mechanism, such for example as a foot treadle (not shown) connected with an actuating rod 22. This block is movable rearwardly into an inoperative position as shown in Fig. 1, out of the path of movement of the ram. When a pull is exerted on the actuating rod, for example, by depressing the foot treadle the block 21 may be moved forwardly into its operative position, such as shown in Fig. 6, in which it will be located between the lower end of the ram 11 and a part of the plunger 20. When the block 21 is in its operative position, the ram in its downward movement will engage the block and through the medium of the block will force the plunger 20 downwardly to the lower limit of its working stroke.

Any suitable means may be provided for moving the block 21 into and out of its operative position between the ram and the plunger, and in the construction shown, the block is moved into its operative position by applying a pull downwardly on the actuating rod 22. The upper end of the rod 22 is pivoted to one arm 25 of the bell crank lever pivoted at 26 on the frame of the machine. The other arm 24 of this bell crank lever is pivotally connected to one end of a link 28, the other end of which is pivotally connected to an arm 29 of a second lever pivoted at 30 on the frame of the machine. This lever has another arm 31 to which one end of a link 33 is pivoted, the other end of this link being pivotally connected to the block 21 in any suitable manner. Consequently, when the actuating rod 22 is pulled downwardly, it will be noted that the link 33 will push the block 21 to the left in Fig. 1, so that the same moves into the operative position shown in Fig. 6. A counterweight 34 is provided on an arm 35 which is suitably secured to the lever connecting the links 28 and 33 so that this counterweight ordinarily urges the block 21 into its inoperative position shown in Fig. 1. Any other means for yieldingly urging the block 21 into its inoperative position may be provided, if desired.

The block 21 is guided to move on a flat surface of the plunger 20, and the block may be guided in its movement in any suitable or desired manner. In the construction shown, the block is provided at opposite sides thereof with flanges 36 which extend into grooves 37 formed in the plunger 20. The upper face of the block is preferably shaped to receive the lower end of the ram 11, for example, by providing the upper face of the block with a concave surface into which a correspondingly shaped convex lower end of the ram 11 may seat when the block is in operative position.

It has been found very desirable for proper operation of the press to provide means for stopping the movement of the block 21 into operative position at all times except when the ram 11 is near its upper position. In order to accomplish this, a stop is provided which will lock or prevent

movement of the block actuating mechanism in a direction to move the block into operative position, except when the plunger is in or near its upper position, and in the construction shown for this purpose, I have provided a bell crank lever 40 pivoted at 41 on the frame of the machine and biased to swing in a clockwise direction in Fig. 1. This may be accomplished by means of an arm 42 which is relatively heavy so that this bell crank lever will tend to swing into the position shown in Fig. 1. The upper lever arm 31 is provided with a tooth 43, and the weighted stop arm 42 is provided with a similar stop tooth 44 which will engage with the tooth 43 when the ram 11 is out of its upper position. By swinging the bell crank lever 40 about its pivot in a counterclockwise direction, as seen in Fig. 1, the stop shoulder or tooth 44 will be moved out of engagement with the tooth 43, and thus permit the actuating mechanism to move the block 21 into its operative position. This shifting of the bell crank lever 40 out of its stop position may be accomplished in any suitable or desired manner, and in the construction illustrated, the lever 12, to which the ram 11 is pivoted is provided with a projection 45 which is arranged to swing the bell crank lever 40 when the ram 11 is near its upper position. For this purpose, the bell crank lever 40 is provided with an arm 46 extending into the path of movement of the projection 45. Preferably a set screw 47 is provided on the arm 46 in position to be engaged by the projection 45 and this set screw may be adjusted so that the shoulder 44 will swing out of engagement with the shoulder 43 at a time when the ram is near its upper position. 40 represents a lock nut by means of which the set screw may be secured in its adjusted position.

In the operation of this portion of the press, when downward pressure is exerted on the actuating rod 22 to move the block 21 into its operative position, such movement of the actuating rod 22 and the links and levers connected therewith will be stopped until the shoulder 44 moves out of engagement with the shoulder 43, which will happen only when the ram is near its upper position, whereupon further movement of the actuating rod results in the positioning of the block 21 in its operative position. When pull on the operating rod 22 is released, the weight 34 will automatically pull the block 21 out of its operative position between the ram and the plunger, so that the press will not repeat, except when the operator maintains a downward pull on the rod 22.

In power presses of this type, the block when in operative position serves only to move the plunger downwardly, and a pawl is commonly provided which connects the plunger with the ram in such manner that the ram moves the plunger upwardly to disengage the tool 19 from the work. In the construction shown for this purpose, the plunger 20 is of substantially U shape, see Figs. 3 and 4, and includes two upwardly extending arms 50 and 51 between which the ram 11 reciprocates. A pawl 52 is pivotally mounted on the leg 50 of the plunger, the pawl having a ram engaging tooth 53 which is formed to enter into a notch or recess 54 in the ram, the pawl being weighted or otherwise biased so that the tooth 53 thereof normally swings into engagement with the notch 54 in the ram.

It has been found desirable to release the pawl for engagement with the ram while the ram is at or near the upper portion of its stroke so that the ram and the plunger will be fully locked together by means of the pawl before the punch

penetrates the work. This has been found very desirable, but particularly so when the work is of a nature which is difficult to punch or shear, for the reason that when heavy pressure is exerted by the ram on the plunger and punch, then, when this pressure is suddenly released by the punch passing through the work, the punch and plunger tend to continue this downward movement after penetrating the work. This downward impulse of the plunger after penetrating the work subjects the mechanism to severe strains and causes objectionable noise. It is very desirable, therefore, to provide mechanism for releasing the pawl for engagement with the notch 54 in ample time before the punch penetrates the work, so that the pawl will seat fully in the notch when the pressure on the plunger is released.

In the construction shown for this purpose, the pawl is normally held out of engagement with the ram by means of a retaining or locking pin 57 which is arranged in an aperture extending from the lower face of the plunger upwardly into the leg 50 and into a recess or opening 58 in which the pawl 52 is arranged. For this purpose, the pawl is provided with a relatively flat downwardly facing edge portion 53 which is so located as to be engaged by the upper end of the pin 57. A spring 60 in the aperture of the plunger engages the lower end of this pin and yieldingly urges the pin into its upper or pawl locking or holding position, a set screw 61 engaging the lower end of the spring 60, to enable the spring to be compressed.

Means are provided for moving the locking pin downwardly against the action of the spring 60 when the block 21 is moved into its operative position to be engaged by the ram. In the construction shown for this purpose, the locking pin 57 is of substantially circular cross section and a portion thereof is cut out from the side of the pin, thus leaving a portion 63 of the locking pin of substantially semi-circular cross section. This cut-out portion terminates at its lower end in an inclined surface 64 which is formed to engage with a pusher member 65 arranged to slide in a transversely extending aperture 66 formed in the lower portion of the leg 50 of the plunger. The pusher member has an inclined face 67 engaging with the inclined face 64 of the lock pin. When this lock pin pusher member is in the position shown in Fig. 2, the locking pin 57 is free to be moved into its upper position by means of the spring 60, thus engaging the flat surface 59 of the pawl and holding the pawl out of engagement with the ram. When the pusher member 65 is moved to the left into the position shown in Fig. 4, the cooperating inclined faces of the locking pin and pusher member will result in downward movement of the locking pin, thus permitting the pawl to swing about its pivot into the position shown in Fig. 4, in which the pawl is free to engage the recess 54 of the ram, thus forming a connection between the plunger and the ram which holds the plunger against downward movement relatively to the ram and also enables the ram to move the plunger upwardly after the same has completed its working stroke.

The movement of the pusher member 65 is preferably effected by means of the block 21 in any suitable or desired manner. In the construction shown for this purpose, the pusher member, which extends crosswise of the direction of movement of the block, is provided with an end portion which extends into the path of movement of the block 21 and this end portion is provided with an inclined surface 70, which is

formed to cooperate with an inclined surface 71 of the block. When the block is out of engagement with the pusher member, as shown in Fig. 3, the spring 60 will move the locking pin in its upper position, and the cooperating inclined faces 64 and 67 will cause the pusher member to be moved into the position shown in Fig. 2. When the block is moved into its operative position, the inclined surface 71 thereof engages the surface 70 of the pusher member and moves the same to the left in Fig. 3, into the position shown in Fig. 5, in which the locking pin is moved against the action of the spring 60 into position to release the pawl or dog 52. Since the block can only be moved into its operative position when the ram is approximately at or near its upper position, it will be obvious that the locking pin 57 will be released when the ram is at or near its upper position. If the plunger is also in its upper position at that time, the pawl will immediately enter the recess 54 of the ram. If, however, the plunger has been lowered so that the punch is in contact with the work by mechanism which will be hereinafter described, the tooth or projection 53 of the pawl will yieldingly press against the side wall of the ram and drop into the recess 54 of the ram at about the same time that the ram engages the block 21 during the downward movement of the ram. Consequently, the pawl will be in engagement with the ram during the continued downward movement of the ram and plunger to penetrate the work, and when the work has been penetrated, the shock resulting from the sudden release of the plunger when the punch has pierced the work will be transmitted by the pawl directly to the ram.

It will be noted that adjoining the end of the flat portion 59 of the pawl 52 is an arc-shaped part 75 which is concentric with the pivot pin of the pawl. This arcuate portion 75 of the pawl is so arranged that when the locking pin 57 is in its upper position and the pawl is in engagement with the notch 54 in the ram, the locking pin will be out of contact with the pawl so that the same is free to swing about its pivot. At the juncture of the arc-shaped portion 75 and the flat portion 59, a slight projection is provided over which the upper end of the locking pin 57 will ride into engagement with the flat surface 59 when the pawl is swung about its pivot by the downward movement of the ram near the upper end of its stroke, this projection enabling the locking pin to prevent the pawl from swinging into engagement with the ram when held by the locking pin 57.

When the block is not in its operative position and the ram starts its downward movement relatively to the plunger, the tooth of the pawl is moved by the ram from the position shown in Fig. 4 into its inoperative position shown in Fig. 2, by a cam-like action of the upper edge of the notch 54 on the tooth 53. This will leave the end of the tooth 53 of the cam in very close proximity to and possibly in contact with the ram during the reciprocation of the ram relatively to the plunger. It is desirable to move the cam to a somewhat greater extent from the ram, so that the end of the tooth 53 will be entirely out of contact with the ram. This is accomplished in the construction described by means of the locking pin 57 because of the relative location of the pivot of the pawl and the locking pin 57. It will be noted that the locking pin is located considerably to the left of the pivot of the pawl as clearly shown in Figs. 2 and 4, and consequent-

ly, since upward force is exerted on the locking pin by means of the spring 60, the locking pin will swing the pawl 52 about its pivot to a slight extent so that the end of the tooth 53 will be spaced to a slight distance from the ram 11.

The pusher member preferably has a projection or tooth 73 extending laterally from the inclined face 67 thereof into position to engage the locking pin 57 for the purpose of limiting the movement of the pusher member to the right in Figs. 2 to 5. Any other means for limiting this movement of the pusher member so that the same will not interfere with the movement of the block 21 may be employed. By limiting the movement of the pusher member, the locking pin 57 will also be limited in its upward movement so that it will swing the pawl 52 only to a limited extent to move the tooth 53 out of the pawl out of engagement with the ram.

By positively holding the pawl out of engagement with the recess 54 in the ram until the ram is close to its upper position, it will be noted that the plunger, if lowered into engagement with the work, will not be raised from the work by engagement of the pawl with the ram. Also by releasing the pawl before the ram starts its downward travel, the pawl will have ample time to seat itself completely in the notch 54, so that damage to the pawl due to partial or improper seating of the same will be avoided.

It is at times desirable for the operator to move the plunger and punch or other tool mounted thereon downwardly so that the tool may be brought into contact with the work for accurately locating the same with reference to the work resting on the die 18. In the construction shown for this purpose, a hand lever 80 is provided which has a hub 81 pivoted on the plunger guide. The hub is suitably connected with a yoke or slotted arm 83, for example, by means of cooperating clutch faces 84 on the hub 81 and the yoke 83. This yoke as shown in Fig. 1 has a slot into which a pin 85 secured to the arm 51 of the plunger extends. The pin is movable vertically in a slot or recess 87 formed in the plunger guide. Consequently, it will be obvious that by swinging the lever 80 about its pivot the plunger may be moved up and down through the medium of the pin 85.

It is desirable to have the plunger counterbalanced in such a manner that it can be easily moved upwardly or downwardly by means of the lever 80, and in the construction shown for this purpose, a spring 88 is provided for counterbalancing the weight of the plunger and the tool mounted thereon. The lower end of this spring is seated in a recess in the upper portion of the plunger guide and the other end of the spring bears against a collar 89 which cooperates with a knurled nut 90 having a threaded engagement with the upper end of the rod 91. The lower end of this rod is secured to the outwardly extending pin 85. The nut 90 is, consequently, readily accessible for varying the compression of the spring 88 in such a manner as to counteract the weight of the plunger and the tool mounted thereon to any extent desired by the operator. When different tools are mounted on the plunger, the nut can readily be adjusted to counterbalance tools of different weights. The spring may, for example, be adjusted so that the plunger will remain in its upper position after completing its working stroke, or if desired, the force exerted by the spring may be reduced so that

after each operation, the plunger floats slowly down after each working stroke.

The pin 85 and the recess 87 are so designed that if, for any reason, the pawl 52 should fail to engage the ram, the downward movement of the plunger 20 will be limited by engagement of the pin 85 in the bottom of the recess or slot 87 in the plunger guide.

It will be understood that various changes in the details, materials, and arrangements of parts which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention, as expressed in the appended claims.

I claim as my invention:

1. In a power press having a reciprocatory ram movable in an up and down direction, a tool carrying plunger, a block movable into and out of an operative position between a part of said ram and a part of said plunger, and mechanism controlled by the operator for moving said block into operative position, that improvement which includes a pivoted stop member biased to swing into a position to prevent movement of said mechanism to move said block into operative position, and a part connected with said ram and movable into engagement with said stop member for swinging the same out of its movement preventing position when said ram is near the upper end of its path of movement.

2. In a power press having a reciprocatory ram movable in an up and down direction, a tool carrying plunger, a block movable into and out of an operative position between a part of said ram and a part of said plunger, and mechanism controlled by the operator for moving said block into operative position, that improvement which includes a movable stop member having a shoulder, a part on said operator controlled mechanism which also has a shoulder, means for biasing said stop member to move into a position in which the shoulder thereon is in the path of movement of said shoulder of said mechanism, and a part connected with said ram and positioned to engage said stop member when said ram is near its upper position, for moving said stop member into a position in which the shoulder thereon is out of engagement with said shoulder of said mechanism.

3. In a power press having a reciprocatory ram movable in an up and down direction, a tool carrying plunger, a block movable into and out of an operative position between a part of said ram and a part of said plunger, and mechanism controlled by the operator for moving said block into operative position, that improvement which includes an arm forming a part of said mechanism and connected with said block for moving the same into and out of operative position, a pivoted stop member normally engaging a part of said arm to prevent swinging of the same in a direction to move said block into its operative position, and a part connected with said ram and moving said stop member out of engagement with said arm when said ram is near the upper portion of its movement, to release said arm for moving said block into operative position.

4. In a power press having a reciprocatory ram movable through a power stroke to force a tool through the work and through a return stroke to withdraw the tool from the work, an oscillatory lever connected with said ram for imparting reciprocatory motion to said ram, a tool carrying plunger, a block movable into and out of operative position between a part of said ram and a part of said plunger for imparting movement to said

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ram in one direction to said plunger, and mechanism controlled by the operator for moving said block into operative position, that improvement which includes an arm forming a part of said mechanism and connected with said block for moving said block into and out of operative position, a movable stop member which normally lies in the path of movement of a part of said arm for preventing movement of said arm in a direction to move said block into operative position, and an extension on said lever movable into engagement with said stop member when said ram is near the end of its movement in said return stroke, to move said stop member out of engagement with said arm to permit said arm to move said block into its operative position.

5. In a power press having a reciprocatory ram movable in an up and down direction, a tool carrying plunger, a block movable into and out of an operative position between a part of said ram and a part of said plunger, and mechanism controlled by the operator for moving said block into operative position, that improvement which includes a movable arm forming a part of said block moving mechanism, a pivoted stop member having a part which normally lies in the path of movement of said arm to move said block into operative position, and a part connected with said ram and which engages a part of said pivoted stop member to move the same into a position in which said part thereof is out of said path of movement of said arm, said part engaging said stop member only when said ram is near the upper end of its movement.

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6. In a power press having a reciprocatory ram movable in an up and down direction, a tool carrying plunger, a block movable into and out of an operative position between a part of said ram and a part of said plunger, and a pawl mounted on said plunger and movable into and out of engagement with said ram, that improvement for actuating said pawl which includes a locking member movable in a substantially upright direction into and out of engagement with said pawl for holding the same out of engagement with said ram, a substantially horizontally movable part extending into the path of movement of said block and into engagement with said locking member for moving said locking member into pawl releasing position when said block is moved into its operative position, and means for stopping movement of said block into operative position except when said ram is near the upper portion of its path of movement.

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