MEANS FOR SAFEGUARDING OPERATORS ON POWER PRESSES

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Inventor
Alfred William John Wells
By: Marks, McCallum & Berry
Attorneys
Fig. 4.

Fig. 5.

Fig. 6.
This invention relates to means for safeguarding operators on power presses, which expression is to be understood as including stamping and like machines in addition to presses.

In British Patent No. 528,343 I have described safety mechanism such that the shaft of the press cannot be set in motion to cause the ram to descend until after a guard has been moved into a closed position in which it renders it impossible for the operator to move her hand into position beneath the descending ram. In this arrangement a release member on the ram was arranged to release the guard and allow it to return to its open position at or shortly after the completion of the down stroke of the ram. The present invention aims at improving this safety mechanism in various respects.

Firstly a press fitted with such a safety mechanism is not suitable for blanking. The present invention, however, provides a safety mechanism which is effective, like that above-described, to safeguard the operator against injury when the press is used for forming operations, but which can be thrown out of action to permit of rapid repeated operation of the press for blanking, which does not involve risk of injury to the operator's fingers.

The invention accordingly provides a power press adapted for alternative use for forming and for blanking operations, and comprising a guard movable at will from a forming to a blanking position, a locking device controlled thereby, and means for effecting alternative connections between the guard and the locking device such that when the guard is in the forming position the locking device is effective to prevent operation of the press except when the guard is closed and to maintain the guard closed, during operation of the press, until the ram of the press has nearly completed its return stroke, while when the guard is in the blanking position the locking device is ineffective to prevent operation of the press.

Preferably the press includes a non-repeat mechanism, which normally limits the operation of the press to a single stroke at each actuation of a treadle or equivalent actuating member, the non-repeat mechanism having a detachable part which is removable to permit of repeated operation of the press for blanking.

The guard thus has an inoperative position, in which it is placed for blanking and an operative position in which it is placed for forming. When in the operative position it effectively safeguards the operator against injury since the shaft of the press cannot be set in motion unless the guard is closed, and the latter cannot open again until risk of injury to the operator is past. When however the guard is in the inoperative position and connected to the locking device, the latter is held retracted, so permitting continuous operation of the press for blanking. To return the guard to the operative position this connection must be broken, whereupon the locking device is returned by a spring or the equivalent to the safe position, from which, after establishment of the alternative connection with the guard, it can only be moved again by closing the guard.

In the case of the mechanism described in British Patent No. 528,343, the guard is returned to the open position at or shortly after the ram reaches the end of its down stroke. Experience has shown however that it is possible for the operator in some cases to trap her fingers between a projection on the upwardly moving ram and the guard if she moves her hand in too rapidly after the guard opens. The present invention provides mechanism which ensures that the guard will not open until the ram has completed or nearly completed its up stroke.

The press is conveniently set in motion by retraction of a release member which cooperates with the locking device so that, for forming operations, the release member can only be retracted when the guard is closed, and prevents the guard from opening again until it has returned from its retracted position. To ensure that the guard cannot open until the ram has nearly completed its stroke, the shaft of the machine may carry a cam which cooperates with the release member to prevent its return until shortly before the end of the up stroke of the ram.

One form of power press fitted with safety devices according to the invention will now be described in further detail by way of example, with reference to the accompanying drawings, in which—

Fig. 1 is a front elevation of the press,
Fig. 2 is a side elevation,
Fig. 3 is a vertical section through the centre of the press,
Fig. 4 is a rear elevation, with the flywheel removed,
Fig. 5 is an enlarged scrap view of the connection between the guard and an actuating rod for retracting the locking device, and
Fig. 6 is an enlarged sectional view through the operating roller of a non-repeat mechanism.

The guard, which is fitted to the front of the press, comprises two side members joined by a
cross member 11 rotatably mounted thereon. The side members 10 are pivoted near the top on studs 12 screwed into the framework of the press, and having threaded ends on which are fitted nuts 13 to retain the side members 10 on the studs 12. The guard can be swung about the studs 13 from a down operative position (shown in full lines in Fig. 2) in which it rests in front of the work to an up inoperative position (shown in chain-dotted lines in Fig. 2) in which it is out of the way for blanking.

To each side member 10 is fixed a forked member 14 which, in the operative position of the guard, engages over one end of a cylindrical cross bar 15 fitted to the machine frame. The outer faces of the forked members 14 are serrated (see Fig. 1); and nuts 16 screwed on to the ends of the bar 15 can be screwed down to engage serrated washers 17 threaded on the ends of the bar with the serrations in the forked members 14 to lock the guard in position. This provides an adjustment for varying the spacing of the guard from the press as may be required to suit press tools of different dimensions. Linch pins 18 at the ends of the bar prevent the nuts 16 from being removed or lost.

The guard is formed of two sections, a lower section 19 which can slide up and down in the side members, and an upper section 20 which is fixed to the cross member 11. The lower section 19 has top and bottom cross members 21, 22 which slide in slots 23 in the side members 10, and is connected to the upper section 20 by links 24, pivoted at their lower ends to the member 21 and at their upper ends to links 25 fixed to the cross member 11. The lower section normally tends by gravity to assume a lower position (shown in chain-dotted lines in Fig. 3) in which it permits of access to the operator to the lower die 26 of the press. In this open position of the guard, the upper section 20 is swung inward by the links 25 into the chain-dotted position in Fig. 3.

To close the guard the operator grasps the lower edge of the upper section, drawing it into the plane of the lower section, which is thereby pulled upwards to meet the upper section. In this position (shown in full lines in Fig. 3) it is impossible for the operator to put her hand into the press.

A cavity 27 in the body of the press is located a locking bolt 28 which extends at right angles to the plane of the guard and is normally pressed rearwardly by a spring 29 to engage a hole 30 in a release slide 31, and so prevent the latter from being moved to set the press in operation. Beneath and offset from the locking bolt 28 is a rod 32 for actuating it. This actuating rod is cranked inwardly at 33 (Fig. 4) near its rear end and terminates in a rearwardly extending fork 34 engaging a link 35 which is pivoted at its upper end to a rod 36 journaled in the machine frame. On the rod 33 is fixed a bell crank lever 37, one arm 38 of which has a slot 39 engaging a pin 40 on the locking bolt 28. The rod 33 is pivoted at its front end to an arm 41 fixed to the cross bar 11. When the guard is open, the locking bolt 28 is in the locking position. On swinging the upper section into position to close the guard, however, the actuating rod 33 is pulled forward to withdraw the locking bolt 28 and free the release slide 31 as shown in Fig. 3. The latter is then able to move down, as later described, when the operator presses a treadle (not shown) thereby permitting the ram to descend.

The guard cannot open again until the release slide has returned to its original position, in which the hole 45 in it is in register with the locking bolt 28. Only when this condition is fulfilled can the spring 29 move the latter rearwardly into locking position, thereby opening the guard through the agency of the actuating rod 33. This locking mechanism is similar in principle to that described in British Patent No. 588,343 but has the advantage over the latter that it is enclosed in the body of the press, instead of being mounted on the side of the press. It is therefore impossible to tamper with it or put it out of alignment.

The connection between the actuating rod 33 and the arm 38 is a readily detachable one. The forward end 40 of the rod is forked (Fig. 5) to receive the end of the arm 38, and these parts are secured together by a transverse pin 41 passing through registering holes in the arm and in the limbs of the forked end of the rod. These holes are of keyhole form, the slots registering and serving to accommodate a projection 42 on the end of the pin 41. After insertion, the transverse pin is turned to bring the projection 42, which now rests against the outer surface of one limb of the rod, out of register with the slots (see Fig. 5). To uncouple the parts it is turned back until the projection is opposite the slots, when it can be drawn forward.

In the raised inoperative position of the guard, to which it can only be moved after uncoupling the arm 38 from the rod 33, slotted extensions 43 of the side members thereof engage over studs 44 fitted to the machine framework. Nuts 45 on these studs, which are held against removal by linch pins 46, are then screwed down to retain the guard in the raised position. In this position it is necessary that the locking bolt 28 should be withdrawn. To this end a prolongation 47 of the left hand extension 43 is coupled to a bump 48 on the actuating rod by passing the pin 41 through holes 49, 50 in these parts, and the rod is thus held in position (see chain-dotted lines in Fig. 2) to maintain the locking bolt withdrawn. The guard cannot, of course, be returned to the down position without removing the pin and so allowing the locking bolt to return to the locked position.

At the rear of the press (Fig. 4) is the release slide 31 referred to above. This is urged outward by springs 52 to an up position in which it is locked by the locking bolt as already described. When in the up position the upper end 33 of the release slide engages a pivoted dog 54, mounted to turn with the shaft 55, and retain it in a position in which the shaft is not coupled to the rotating flywheel 56 (Fig. 1). On downward retraction of the release slide 31 to free the dog 54, a spring 57 causes the dog to turn thereby clutching the shaft 55 to the flywheel 56 by means of a key 58, as described in my preceding application No. 521,594, and causing the ram 10 (Fig. 3) to descend. After the shaft has almost completed a revolution, the dog 54 is intercepted by the release slide 31, which at this stage has returned to the up position as described below, thereby de-clutching the shaft and permitting the ram to descend a second time. The shaft carries a cam 59 arranged to actuate a brake 60 towards the end of the upward stroke of the ram.

On depression of the treadle, a rod 61 at the rear of the press is caused to rise. This rod is pivoted to one end of a link 62 pivoted centrally to a fixed point 63 on the frame and pivoted at
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its other end to a release bar 64. When there-
fore the trigger is depressed this release bar is
called to descend. The release bar is formed with a projecting latch 65 and a spring 66 nor-

mally holds the release bar in a position in which the latch engages nose 67 on the re-
lease slide 31. Downward movement of the re-
lease bar 64 will therefore, provided the locking
bolt has been withdrawn by closing the guard,
draw the release slide 31 down to free the dog
and engage the clutch. On the shaft of the press
is mounted a cam 68 operating with a roller
69 at the upper end of the release slide. This
cam is so shaped that, notwithstanding release
of the pressure of the operator's foot on the
treadle, the springs 52 associated with the release
slide cannot lift the latter back into its up posi-
tion until some time during the last quarter of
the up-stroke of the ram. As explained above,
the hole in the release bar is only brought into
register with the locking bolt to permit of rear-
ward movement of the same to open the guard,
when the release slide has returned to the up
position.

To prevent a repeat stroke of the ram, in case
the operator should maintain the pedal de-
pressed, a roller 80 is provided on a member 70
fixed to the shaft. This roller strikes the release
bar 64 during the up-stroke of the ram, causing
the release bar to pivot about its lower end
against the action of its spring 66 sufficiently
to free the latch 65 from the nose 67 of the re-
lease slide. The latch will therefore be lifted
to its up position by its springs 52 and locked by
the roller, the associated cam 68 permitting
such upward movement at this stage. When the
roller 80 has passed the release bar, the later springs back into position to bring the
latch below the nose on the release slide. On
release of the pedal, however, the release bar will
rise, the latch wiping over the nose on the release
slide and engaging above it to reset the parts in
their original position.

When the press is to be used for blanking the
non-repeat roller 80 is removed. This roller (see
Fig. 6) has a threaded shank 71 fitting into a re-
cess in the supporting member 70. This recess
contains a split cone 72 held in position so that
it cannot fail out when the roller is removed and
locked against rotation by a key 73. A threaded
recess 74 is provided in one of the brake members
and the shank of the roller can be screwed into
this recess, to ensure that the roller will not go
astray, when it is required to put the non-repeat
mechanism out of action.

A further safety device is provided for ensur-
ing that the guard cannot open, despite the re-
turn of the release slide to the up position, until
the shaft has actually stopped rotating. This
consists of a link 75 (Fig. 3) pivoted to the arm
76 of the bell crank 35, said link carrying a pin
77 which, when the locking bolt 78 is in the lock-
ing position, engages in a hole 79 in the shaft
85. When the guard is closed, this pin 77 is
withdrawn from the hole 78 as an incident to the
retraction of the locking bolt from the hole
in the release slide. The locking bolt cannot,
however, return to the locking position until the
shaft has completed a revolution and stopped,
thus permitting the pin 77 to re-enter the hole
78.

The press includes a shear pin and stop mecha-
nism for safeguarding against flywheel seizure
as described in my copending application No.
521,894.

What I claim as my invention and desire to
secure by Letters Patent is:

1. In a power press, having a reciprocatable ram,
the combination with release means for setting
the press in operation and an actuating member
therefor, of a safety guard support movable at
will in relation to the press between an inopera-
tive position in which it is placed to enable
the press to be used for blanking purposes and
an operative position in which it is placed to enable
the press to be used for forming purposes, a
safety guard which is movable in relation to said
support between an open position and a closed
position in which it prevents injury to the oper-
ator by the ram, a locking device for preventing
effective operation of said release means, and
means for establishing two alternative connec-
tions between said guard and said locking device,
one connection, which can be established only
when the guard support is in the operative
position, serving to render the locking device
inoperative and the other connection, which can
be established only when the guard support is in
the operative position, serving to render the lock-
ing device operative except when the guard is in
the closed position and to maintain the guard in
the closed position so long as the moving ram
can endanger the operator.

2. In a power press, having a reciprocatable
ram, the combination with release means for set-
ting the press in operation and an actuating
member therefor, of a safety guard support mov-
able at will in relation to the press between an
inoperative position in which it is placed to en-
able the press to be used for blanking purposes
and an operative position, in which it is placed to
enable the press to be used for forming purposes,
a safety guard which is movable in relation to said
support between an open position and a closed
position in which it prevents injury to the oper-
ator by the ram, a locking device for preventing
effective operation of said release means, and
means for establishing two alternative connec-
tions between said guard and said locking device,
one connection, which can be established only
when the guard support is in the operative
position, serving to render the locking device
inoperative and the other connection, which can
be established only when the guard support is in
the operative position, serving to render the lock-
ing device operative except when the guard is in
the closed position and to maintain the guard in
the closed position so long as the moving ram
can endanger the operator, and a non-repeat
mechanism for normally limiting the operation of the
press to a single stroke of the ram on each actua-
tion of the release means, said non-repeat
mechanism including a detachable part, which is
removable to disable said mechanism when the
press is to be used for blanking.

3. In a power press, having an intermittently
rotating drive shaft, and a reciprocatable ram
operated by said shaft, the combination with a
release member for setting said shaft in rotation,
of an actuating member for operating said release
member, a guard frame fitted to the press, and
movable in relation thereto between operative
and inoperative positions, a safety guard which
is movable in relation to said guard between
open and closed positions, a locking device con-
nectable by alternative connections to the guard
in the operative and inoperative positions of its
support, and a device for biasing the locking de-
vice to a locking position in which it prevents
effective operation of said actuating member, the connection between the locking device and the guard in the inoperative position of the guard frame serving to hold the locking device permanently retracted from its locking position and the connection between the locking device and the guard in the operative position of the guard frame serving to retract the locking device from its locking position when, and only when, the guard is closed and to reopen the guard when it is safe to do so.

4. In a power press, having a press body, an intermediately rotating drive shaft, a reciprocatable ram operated by said shaft, and a constantly rotating drive member, the combination with a release slide, of an actuating member for operating said release slide to couple said drive shaft to said drive member, a locking bolt housed in a recess in the body of the press and biased to normally engage the release slide to prevent operation thereof, a retraction member for withdrawing said locking bolt from engagement with said release slide, a guard frame fitted to the press and movable in relation thereto between operative and inoperative positions, a safety guard, which is movable in relation to said frame between open and closed positions, and means for effecting alternative connections between said guard and said retraction member, one connection, which can be made only when the guard frame is in the inoperative position, serving to hold the locking bolt permanently retracted, and the other connection, which can be made only when the guard frame is in its operative position, serving to retract the locking bolt when, and only when, the guard is closed and to reopen the guard when it is safe to do so.

5. Apparatus as claimed in claim 4, which comprises a pin linked to the locking bolt and arranged to engage in a hole in the shaft when the bolt is in the locking position, the hole being in register with the pin only at the start and finish of the cycle of operation.

6. In a power press comprising an intermittently rotating drive shaft, a reciprocatable ram operated thereby, a constantly rotating drive member, and a clutch dog for coupling said drive shaft to rotate with said drive member, the combination with a release member, of a biasing device for holding said release member in engagement with said dog to hold the latter inoperative, an actuating member and a linkage connecting the same to the release member, said actuating member being operable to withdraw the release member to free the dog and thereby set the shaft in rotation, a locking bolt cooperating with the release member and biased towards a locking position to which it cannot move when the release member is withdrawn and in which it locks said release member against withdrawal, a movable safety guard operatively connected to the locking bolt and operating to withdraw it from the locking position when said guard is closed, a non-repeat mechanism constituted by a linkage member, forming part of the linkage aforesaid, and a member carried by the drive shaft and arranged, if necessary, to displace said linkage member shortly before the end of the machine cycle, to free the release member and permit of its return to disengage the clutch before completion of said cycle.

7. Apparatus as claimed in claim 6, in which the guard is detachable from the locking bolt and movable into an inoperative position to permit of blanking operations, the guard, when in the inoperative position, being capable of reconnection to the locking bolt to hold the latter permanently retracted and the member on the shaft being detachable so as to render the non-repeat mechanism ineffective during blanking operations.

8. Apparatus as claimed in claim 6, in which said linkage member carries a latch normally engaging a nose on the release member, so that movement of the linkage member on operation of the actuating member is effective to withdraw the release member against the action of its biasing device, the member on the shaft causing the linkage member to pivot and free the nose on the release member from the latch, thereby enabling the biasing device to return the release member into position to stop the press.

9. In a power press comprising an intermittently rotating drive shaft, a reciprocatable ram operated thereby, a constantly rotating drive member, and a clutch dog for coupling said drive shaft to rotate with said drive member, the combination with a release member, of a biasing device for holding said release member in engagement with said dog to hold the latter inoperative, an actuating member for withdrawing the release member to free the dog and thereby set the shaft in rotation, a locking bolt cooperating with the release member and biased towards a locking position to which it cannot move when the release member is withdrawn and in which it locks said release member against withdrawal, a guard operatively connected to the locking bolt and operating to withdraw it from the locking position when said guard is closed, and a cam on the shaft cooperating with the release member to prevent the latter from returning from the withdrawn position, and thereby permitting the locking bolt to open the guard by returning to the locking position, until shortly before the ram reaches the end of its return stroke.

ALFRED WILLIAM JOHN WELLS.