SAFETY CONTROL FOR PUNCH PRESSES AND THE LIKE

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Application March 4, 1942, Serial No. 433,366

7 Claims. (Cl. 192—134)

This invention relates to safety controls for machines which have an operating or an opening and closing movement dangerous to the operator, as pressing machines, it being here shown as applied to a punch press. It has for its object a guard movable into and out of position to shield the working zone, which guard, when it moves to closed position or a predetermined distance toward closed position controls the operation of the press by its power actuating mechanism.

It further has for its object such a guard which is power operated and connected into a power control system, which is operator controlled, as for instance, by a pedal, which system also has therein, means for delaying the power to another instrumentality in the system for controlling the operation of the machine by its power actuating mechanism, when the guard has been moved by power into a predetermined distance toward closed position.

It further has for its object such a guard connected in a power control system controlled by the operator, as by a pedal, which system is pressure operated or pneumatic and the flow of power to control the operation of the machine by its power actuating mechanism is timed and delayed by the power actuation of the guard, until the guard has moved into or a predetermined distance toward closed position.

It further has for its object a power control system for the guard for machines in which the head or punch makes one reciprocation in each cycle of movement, and means by which the power control system is released during each reciprocation to permit the guard and other parts to return to starting position.

The invention consists in the novel features and in the combinations and constructions hereinafter set forth and claimed.

In describing this invention, reference is had to the accompanying drawings in which like characters designate corresponding parts in all the views.

Figure 1 is a front elevation of one form of conventional punch press embodying this invention.

Figure 2 is a diagrammatic view illustrating the power control system for the guard.

Figure 3 is a sectional view through the clutch on approximately line 3—4, Figure 1.

Figure 4 is a plan view of the guard, the bed and the lower die being also shown.

The press may be of any suitable form, size and construction, and the construction of the press per se forms no part of this invention.

The press includes a suitable frame 1 having overhanging arms or brackets 2 and also suitable guides or ways 3 for a reciprocating head 4 carrying a punch 5 which is movable toward and from a bed or die 6 carried on the table 7 of the machine.

The actuating mechanism for the head 4 may also be of any suitable or standard construction, that here shown including a fly wheel 8, which is power actuated in any well known manner, a crank shaft 9 journalled in the brackets 2 and having the crank thereof connected to the head 4 by the usual connecting rod 10. The fly wheel 8 is here shown as mounted directly on the crank shaft 9 instead of connected thereto through gearing and is rotatable about the shaft 9. It is connectable to and disconnectable from the shaft 9 through a clutch mechanism designated generally 11. The clutches used in punch presses are of different types, and in some types a jaw clutch is used in which one section rotates with the fly wheel 8 and the other section with the crank shaft, one section being shiftable into and out of engagement with the other and normally out of engagement therewith and shiftable by the operator by any suitable mechanism, as pedal mechanism, into engagement, and automatically shiftable out of engagement at the end of each operation in the cycle of movement. There are other types of clutches, as so-called key clutches and pin clutches. The type of clutch used herein is of the sliding key type, and as the construction and operation thereof is well known, further description is thought to be unnecessary. In so far as this invention is concerned, it is merely to be borne in mind that the operation of the control mechanism to be described engages the clutch, so that the crank shaft 9 is operated with the rotating fly wheel 8 to which the power is applied, and when the crank shaft is completing one revolution, the clutch is automatically disengaged, this being the conventional operation of a punch press mechanism.

In punch presses, the clutch mechanism often times includes means to prevent repeating in case the operator neglects to release the foot pedal after depressing it. In so far as this invention is concerned, the clutch may or may not embody means for preventing repeating.

This invention relates solely to a power control system for controlling the engaging of the clutch and including means operated by the operator which is also power operated, to delay the engaging of the clutch until the guard has been moved to a safety position, that is, into closed position.
2 or a predetermined distance toward closed position. 12 designates the guard, this being shaped to enclose the working zone between the head 4 and bed 6, when in closed position, it preferably encloses the front and two lateral sides, and being spaced from the back of movement of the punch sufficiently to encounter an obstruction in said zone, as one or both hands of the operator. The guard is shown as formed with suitable upright guide rods 13, slidable in guides 14 and 15 provided on the frame 2. The guard is power actuated and connected in a power control system including a motor, which serves to relay the power to an instrumentality which controls the throwing in of the clutch 11. As the power control system is here illustrated as pneumatic, these instrumentalties are air operated and the control members therein are valves.

The motor for actuating the guard is of the extensible type and here shown as including a cylinder 16 and a single acting piston 17 therein, which is actuated by the power in one direction to close the guard against the action of a returning spring 18 here shown as located in the cylinder. The piston rod 19 is pivoted at 20 to the lower side of the guard, it being shown as mounted upon a transverse rod of the frame of the guard. The cylinder has an inlet port 22 at its upper end, and this port is connected in the conduit 21 of a power control system, the conduit extending into the base of the machine, where it communicates through a conduit 22 with the casing 23 of a control valve of the combined intake and exhaust type, this valve being operated by the operator, as by a pedal 24. The valve member in the casing 23 includes a normally closed, spring pressed intake valve head 25, a normally open exhaust valve head 26, these being connected together, so that they act as a unit, and the upper or intake end of the valve casing is connected to a source of compressed air, as through a pipe 27. The pedal 24 is pivoted between its ends at 28 to the frame and has a rearwardly extending arm which acts upon a plunger 29 to operate the movable member in the valve casing 23 to close the exhaust valve head and open the intake valve head 25, the motion of the plunger being transferred to the movable member within the casing 23, through yielding means, as the spring 30 interposed between the plunger 29 and the stem 31 on the exhaust valve head. The plunger 29 and spring 30 are located in a suitable guide casing 32 carried by the frame and allied with the valve casing 23. The stem 31 of the exhaust valve head 26 is guided in a suitable plug 33 in the lower end of the valve casing 23. Upon depression of the pedal 24 by the operator, air will flow from the pipe 27 through the valve casing 23, pipes 22 and 21 into the upper end of the cylinder 16 and actuate the piston therein against the returning spring 18 to close the guard 12 from the full line position shown in Figure 1, into the dotted line position. As the system is pneumatic, the instrumentality of the operator for throwing in the clutch 11 is also a pressure operated motor and includes a cylinder 34 and a single acting piston 35 therein, the rod 36 of which carries a wedge or cam coating with the clutch pin or key to shift the key engaged position of the shaft 8 so that the crank shaft 8 is clutched to the fly wheel 9. As this type of clutch is old and well known, further description is unnecessary to an understanding of the invention. The piston 35 is returned to its starting position, when the air is exhausted from the cylinder 34 by a suitable spring 37. The flow of power controlled by the pedal 24 and control valve 23 to the cylinder 34 is controlled by the movement of the power operated guard 12 and as here shown it is controlled by a normally closed relay valve 38 controlled in its operation by the movement of the piston 17 in the cylinder 16, after the piston has been actuated far enough to close the guard 12 to a safe position.

In the illustrated embodiment of my invention, this delayed operation of the piston 35 is effected by providing a port 39 in the side of the cylinder 16 and located to be passed by the piston 17 when the piston has traveled far enough to actuate the guard to a safety position, the port is connected by a pipe 40 to the pressure side of a diaphragm chamber 41 having a diaphragm 42 therein acting on a plunger 43 which operates a lever 44, the latter operating a plunger 45 which thrusts against the stem of a spring pressed combined intake and exhaust member 46 in a casing 47 normally arranged with its intake head closed and exhaust head open. The casing 47 is connected by a pipe 48 to the pipe 27 and also is connected by a pipe 49 to the intake port 50 of the cylinder 34.

After the piston 17 has been actuated in the cylinder 16 far enough to uncover the port 39, the air passes through the pipe 40 to the diaphragm chamber 41, actuates the diaphragm therein, and thus effects the opening of the relay valve head 46, so that air will now pass through the pipe 48 through the casing 47 of the relay valve 38 and pipe 49 into the intake end of the cylinder 34, actuating the piston 35 therein to cause its rod 36 to throw in the clutch 11, so that the crank shaft 8 is now clutched to the fly wheel 9 and the head 4 carrying the punch is operated first into coaction with the bed 5 and then away from the same, the movement of the punch down being delayed until the guard is closed. If, after the pedal 24 is depressed, and the guard is moving toward closed position, it encounters an obstruction, as the hand of the operator, the guard will be stopped before the piston 17 uncovers the port 39, and hence the clutch 11 will not be thrown in. The area of the piston 17 is comparatively small, so that the blow of the guard against the hand of the operator is extremely light or inconsequential.

The valve member in the casing 23 is also locked in its operated position. As here illustrated, it is so locked by locking the panel 26 in its operated position, as by a diaphragm chamber 51 having a diaphragm therein, which acts on a suitable plunger 52 thrusting against the lever at 53. The pressure side of the diaphragm chamber is connected to the pipe 21 and hence when the movable member in the valve casing 23 is open, air will enter the diaphragm chamber 51 and hold the pedal 24 in its operated position against return movement by its returning spring 54.

The power control system also includes a suitable normally closed, release exhaust valve, which is timed and operated by the opening of the press and releases the air from the cylinder 16, 34 and 51, and hold the diaphragm chambers 41 and 51 in the cylinder 34. This exhaust valve is timed and operated by the crank shaft 8. 55 designates the exhaust valve casing, this having a normally closed, spring pressed exhaust valve head 56 therein, the casing being connected to any pipe in the power system.
control system, as the pipe 21, and having an outlet 57 to the outer air. The valve head 56 is shown as timed and opened by a cam 58 on the crank shaft and having a roller or follower 59 carried by a lever 60, which lever thrusts against the stem 61 of the exhaust valve head 56. The lobe of the cam 58 is so located as to engage the roller 59 as the crank shaft 9 is completing one revolution and the head 4 completing one reciprocation. Upon the opening of the exhaust valve, obviously air will exhaust from the cylinder 16, permitting the spring to return the guard to its starting position. At the same time that air exhausts from the cylinder 17, air will also exhaust through the pipe 40 from the diaphragm chamber 41 permitting the intake valve head 46 of the member of the relay valve 28 to close under the action of its spring and the exhaust valve head to open, so that air will then exhaust back through the pipe 49 from the cylinder 34, permitting the piston 35 to return to its starting position, under the influence of the spring 37, and thus effect the throwing out of the clutch 41. At the same time, air is exhausted from the diaphragm chamber 51 through the pipe 21, permitting the pedal 24 to return to its starting position for the next operation.

What I claim is:

1. A control mechanism for machines having an opening and closing movement and including a head movable toward and from a bed, and power mechanism for actuating the head, said control mechanism including a guard movable into and out of position to shield the working zone between the bed and the head, an operator control power system having power operated means therein for controlling the actuation of the head by its power actuating mechanism, power operated means connected in said operator controlled power system for actuating the guard, and controlling the flow of power to the former power operated means and operating to permit the flow of power to the former power operated means only after the guard has been moved a predetermined distance toward closed position.

2. A control mechanism for machines having an opening and closing movement and including a head movable toward and from a bed, and power mechanism for actuating the head, said control mechanism including a guard movable into and out of position to shield the working zone between the bed and the head, an operator controlled power system having means therein for actuating the guard and also means therein in series with the guard operating means to control the actuation of the head by its power actuating mechanism, the guard operating means being operable to delay the flow of power to the other power operating means until the guard has closed a predetermined distance by its operating power means.

3. A control mechanism for machines having an opening and closing movement, including a head movable toward and from a bed, and making one complete reciprocation during each cycle of movement, and power mechanism for actuating the head, said control mechanism including a guard movable into and out of position to shield the working zone between the head and the bed, an operator controlled power system, power operated means wherein for controlling the actuation of the head by its actuating mechanism, power operated means in said operator controlled power system for actuating the head, and controlling the flow of power to the former power operated means in the control system and operating to permit the flow of power to the former power operated means in the control system only after the guard has been moved a predetermined distance toward closed position, and means operated by the head actuating mechanism during each cycle of movement for de-energizing both of said power operated means in the control system.

4. A control mechanism for machines having an opening and closing movement and including a head movable toward and from a bed, and power mechanism for actuating the head, said mechanism including a guard movable into and out of position to shield the working zone between the bed and the head, a power control system having a foot operated control member therein, power operated means in said system for controlling the actuation of the head by its actuating mechanism, power operated means connected in said power control system for actuating the guard and controlling the flow of power to the former power operated means in the control system, and operating to permit the flow of power to the former power operated means in the control system only after the guard has been moved a predetermined distance toward closed position.

5. A control mechanism for machines having an opening and closing movement and including a head movable toward and from a bed, and making one complete reciprocation during each cycle of movement, and power mechanism for actuating the head, said mechanism including a guard movable into and out of position to shield the working zone between the head and the bed, a fluid power control system, an extensible pressure operated motor connected in said system and connected to the guard to operate the same, a second motor for controlling the actuation of the head by its actuating mechanism, and a relay valve having pressure operated means for operating it connected in series with the motor for the guard, said valve, when open, permitting the flow of power to the second motor, an operator operated valve in said system operable to control the flow of power to the guard motor, the guard motor being operable to permit the flow of power to the relay valve operating means only after the guard motor has been extended to close the guard a predetermined distance.

6. A control mechanism for machines having an opening and closing movement and including a head movable toward and from a bed, and making one complete reciprocation during each cycle of movement, and power mechanism for actuating the head, said mechanism including a guard movable into and out of position to shield the working zone between the head and the bed, a fluid power control system, an extensible pressure operated motor connected in said system, and connected to the guard to operate the same, a second motor for controlling the actuation of the head by its actuating mechanism, a relay valve having pressure operated means for operating it connected in series with the motor for the guard, said valve, when open, permitting the flow of power to the second motor, an operator operated valve in said system operable to control the flow of power to the guard motor, the guard motor being operable to permit the flow of power to the relay valve operating means only after the guard motor has been extended to close the guard a predetermined distance, and releasable pressure operated means in said control system.
4. holding the operator operated control valve in its operated position.

7. A control mechanism for machines having an opening and closing movement and including a head movable toward and from a bed, and making one complete reciprocation during each cycle of movement, and power mechanism for actuating the head, said mechanism including a guard movable into and out of position to shield the working zone between the head and the bed, a fluid power control system, an extensible pressure operated motor connected in said system and connected to the guard to operate the same, a second motor for controlling the actuation of the head by its actuating mechanism, a relay valve having pressure operated means for operating it connected in series with the motor for the guard, said valve, when open, permitting the flow of power to the second motor, an operator-operated valve in said system operable to control the flow of power to the guard motor, the guard motor being operable to permit the flow of power to relay valve operating means only after the guard motor has been extended to close the guard a predetermined distance, releasable pressure operated means in said control system for holding the operator operated control valve in its operated position, and an exhaust valve in said system operated by the head actuating mechanism to time and open the same once during each reciprocation of the head.

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