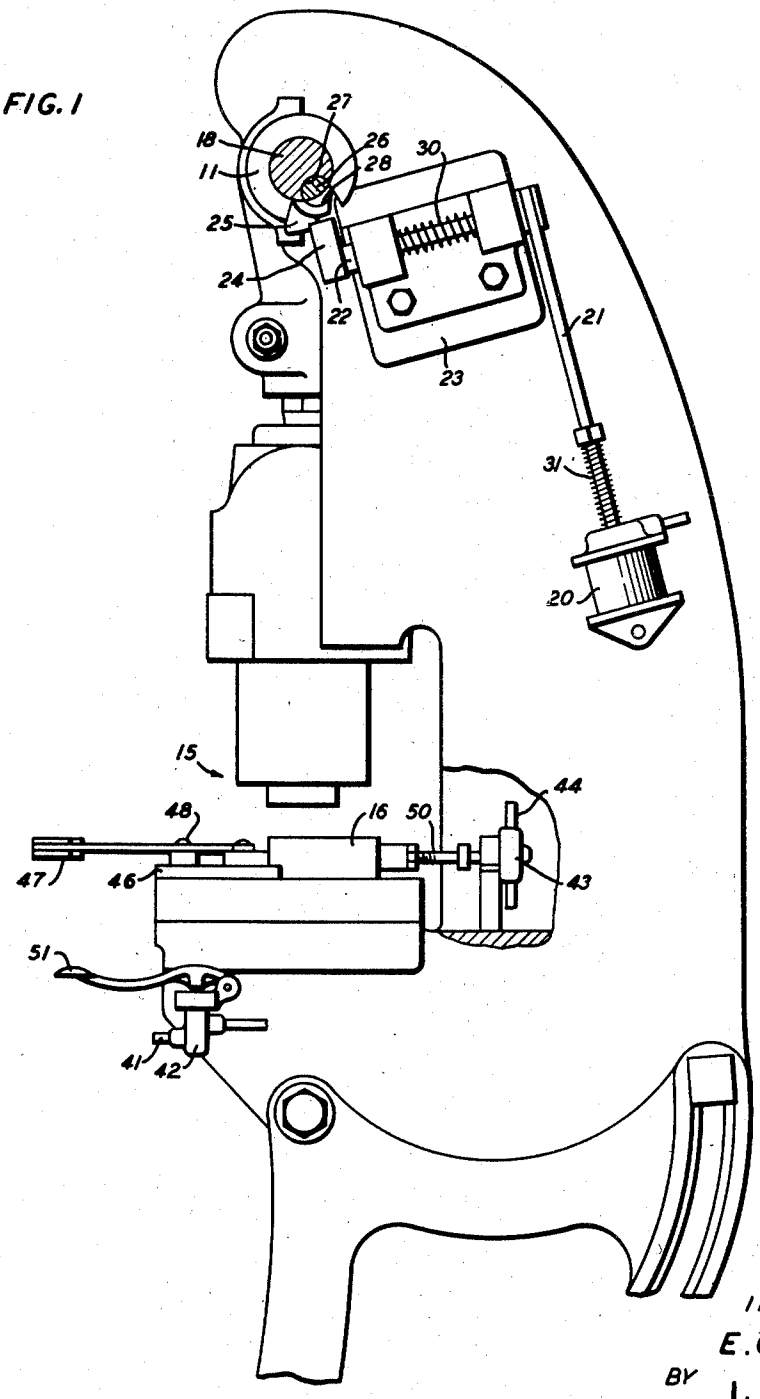
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SAFETY CONTROL FOR MACHINE TOOLS

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FIG. 1



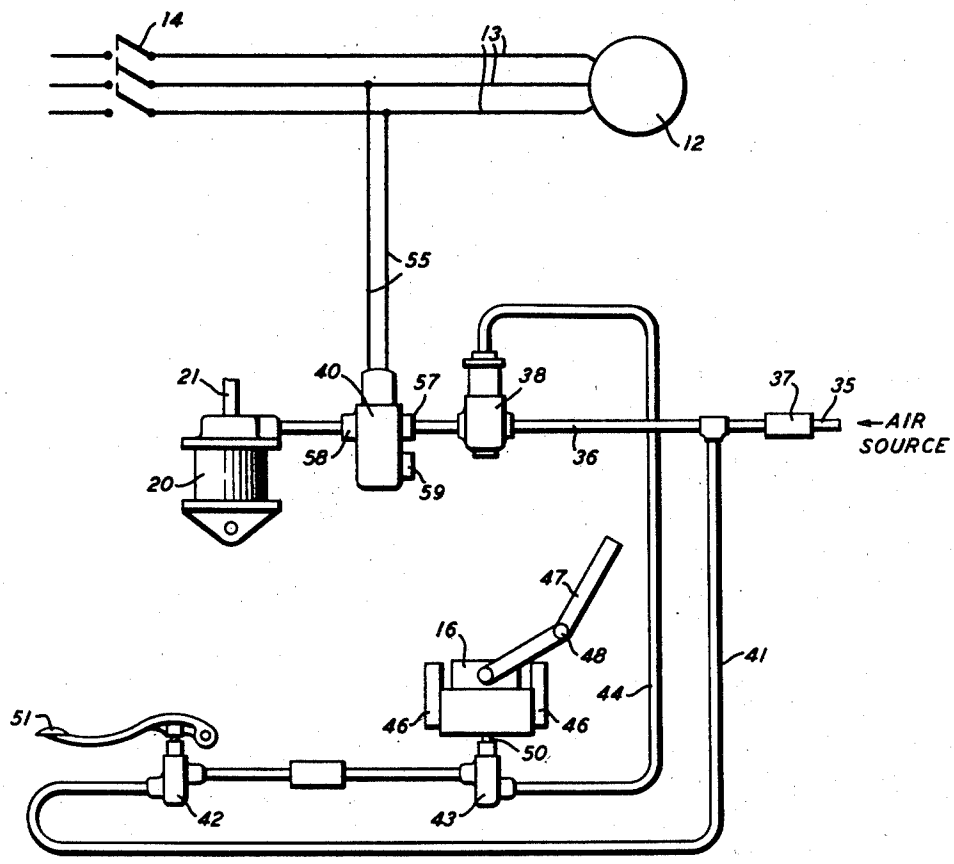
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FIG. 2



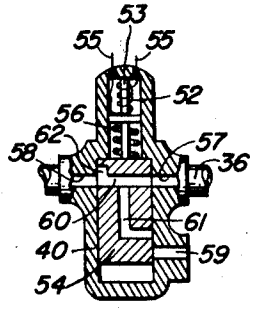


FIG. 3

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SAFETY CONTROL FOR MACHINE TOOLS

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1 Claim. (Cl. 192—129)

This invention relates to safety devices and more particularly to a device for use in safeguarding the operation of punch presses.

Punch presses are inherently a source of potential danger and accidents, and much thought has been given in the past to ways of preventing accidents in connection with their operation. Many safety devices have resulted from the need of improving the safety of this type of equipment.

One conventional type of press has a flywheel driven by a motor with a shaft for actuating the ram of the press being connected to the flywheel by clutching action. The clutch is operated by compressed air power through a hand or foot operated valve.

In many presses of this type, it is possible for the clutch valve to be operated when the flywheel driving motor has been shut off, thus causing the ram actuating shaft to be connected to the flywheel during the shutdown period of the press. As a result, when the main driving motor was started again, the ram would descend unexpectedly, possibly often resulting in a serious accident.

It is therefore an object of this invention to insure that the tool actuating means of a punch press is not accidently clutched to the main driving motor when the latter has been stopped.

In the preferred embodiment of the invention, applicant accomplishes his object by placing a safety valve in the supply line of the clutch engaging cylinder, this safety valve being interlocked with the control circuit for the main motor drive so that when the motor is stopped, the cylinder air supply is shut off and the cylinder is exhausted to the atmosphere.

Other objects and advantages will be apparent from the following detailed description taken in conjunction with the attached drawings in which:

Fig. 1 shows a punch press of the type to which the invention is applicable;

Fig. 2 is a schematic diagram of the valve and air supply circuit used in the safety device, and

Fig. 3 is a vertical sectional view of the safety valve shown in energized or operated position.

With reference to the drawings, Fig. 1 shows a typical punch press having a hub **11** for the main flywheel (not shown). The flywheel with its hub **11** is rotated by a main driving motor **12**, connected to a suitable source of alternating current through leads **13** and disconnect switch **14**. The punch press has a ram generally designated as **15** which acts upon material held in a work holder **16**. The ram **15** is driven, through conventional mechanical connections, by the rotation of a crank shaft **18**.

The shaft **18** is connected by clutching action to the flywheel hub **11** for driving the ram, this action being initiated by the operation of air cylinder **20**. When compressed air is supplied to the cylinder, its piston rod **21** moves upwardly, thereby rotating a small shaft **22** through an intermediate linkage. As the shaft **22**, which is supported by bracket **23**, is rotated, a latch-like projection **24** on the shaft is likewise turned, causing it to clear a lug **25**. When this happens, a key **26** connected to the lug, which is shaped to fit a longitudinal opening **27** in the shaft **18**, is caused by spring means (not shown) to turn and enter a corresponding opening **28** in the flywheel hub **11** when the opening **28** comes into register with the opening **27** of the shaft **18**. The key **26** will now lie partially in each of the two openings **27** and **28**

and will cause the shaft **18** to rotate with the driving flywheel and actuate the ram **15**. If the press is to perform single stroke operations on work, as in the present instance, the air cylinder **30** is actuated momentarily to actuate the projection **24** to free the lug **25**. In this type of press, if the mechanism for freeing the projection **24** of the lug **25** should be actuated while the motor **12** is deenergized, the conventional self-actuating clutch will move its lug only a small distance but sufficient to prevent the projection **24** from moving back into its holding position. If such condition should arise, the clutch would connect the shaft to the flywheel to operate the press the moment the motor is energized. After the shaft **18** starts its single cycle the projection **24** is freed to return to its normal position in the path of the lug **25** moving with the shaft to cause it to rock the key **26** to its original position so that its contour once again coincides with the periphery of the shaft **18**, and the flywheel hub **11** will then rotate relative to the shaft instead of driving it. The press is now ready for another operation.

Spring **30** is used to urge the projection **24** on the small shaft **22** to a position normally blocking the lug **25**, while another spring **31** normally urges the piston rod **21** to its unoperated position.

The operation of the punch press as herein described is not intended or claimed as a part of the invention, but is being presented to aid in an understanding of the features of the safety device covered by the present application.

With reference to Fig. 2, the air cylinder **20** for actuating the clutch mechanism of the punch press is supplied with compressed air from a source (not shown) through suitable piping **35** and **36**. Located in this supply line are a conventional air strainer **37**, a main or pilot valve **38**, and a safety valve **40**. The pilot valve **38** is operated by an auxiliary air supply circuit which extends from the main source through piping **41**, hand operated valve **42**, auxiliary valve **43** and piping **44** to the pilot valve **38**. The hand operated valve **42**, which is located close to the press operator, is used to initiate the clutch action to cause the ram to descend. As a safety feature, the auxiliary valve **43** has been placed in the same system in series with the valve **42** and is interlocked with the work holding fixture **16** so that the pilot valve **38** will not be operated unless the work holder is in its required position. This is accomplished by moving the work holder **16** along two guides **46** to its correct position by means of a lever arm **47** acting about a pivot **48**. As the work holder moves into its proper place, it strikes a small rod **50** of the auxiliary valve **43**, thereby opening the valve. The position of this small rod **50** is made adjustable so that the valve **43** may be operated at various desired positions of the work holder.

When the work holder has been properly positioned, and the valve **43** opened, the handle **51** of the hand operated valve **42** is depressed, thereby opening the valve **42**, and since both valves **42** and **43** are now opened, air will be admitted from the main supply line through the auxiliary system to operate and open the pilot valve **38** and allow air to pass through the valve **38** to operate the air cylinder **20**. Suitable resilient means are provided to hold the valves **42** and **43** normally in an unoperated condition so as to prevent movement of the punch press ram unless the operator has one hand on the handle **51** and the other on the lever arm **47** to hold valves **42** and **43** open. This feature insures that both of the operator's hands are clear of the path of the ram as it descends.

One of the primary features of the invention is the placing of the safety valve **40** in the air supply circuit for the air cylinder **20**. This valve is solenoid operated, as illustrated in Fig. 3. A solenoid coil **52** shown schematically in Fig. 3 is disposed in a fixed position in the upper part of the valve housing concentric with a core **53** which is fixed to a central valve member **54**. The coil **52** is energized from the alternating current supply for the main driving motor **12** through leads **55**. The central valve member **54** is normally urged toward its downward or deenergized position by a spring **56** and is provided with connecting passageways **60** and **61**. When

the solenoid coil 52 is energized and the valve operated, ports 57 and 58 will be opened through passageway 60 and port 59 closed, thereby allowing compressed air from the main source to pass through the safety valve 40 and operate the air cylinder 20, assuming that pilot valve 38 has also been opened. When the solenoid is deenergized and the member 54 of the valve is moved by the spring 56, port 57 will close, shutting off the air supply to the cylinder. Port 59 will be connected to port 58 through passageway 60 and 61 including the vertical leg 62 of the passageway 60, with the result that the air in the cylinder 20 will bleed off to the outside atmosphere through the port 59. By connecting the leads 55 of the coil 52 between the driving motor 12 and the disconnect switch 14, the solenoid which operates the safety valve 40 will be energized only when the motor is running to open the fluid line to the cylinder 12 and deenergized when the motor has been stopped by the disconnect switch 14.

Considering now the operation of the punch press with the safety control, let it be assumed that numerous successive operations are to be performed by the press on work. To condition the press for these operations, the switch 14 is closed and remains closed until the operations have been completed or until the operator desires to stop the press, such as for lunch or at the end of the working day. While switch 14 is closed, motor 12 is energized to drive the flywheel 11 and the safety valve 40 is operated into the position shown in Fig. 3 and held operated to open the air line from the pilot valve 38 to the cylinder 20. Now it is possible for the operator to bring about successive operating cycles of the press by causing operation of the valves 42 and 43 through the actuation of the hand levers 51 and 47 respectively, opening the auxiliary air line 41—44 to the pilot valve 38. This will actuate the pilot valve into open position, allowing air under pressure to pass through the pilot valve 38 and safety valve 40 to cylinder 20, actuating the piston rod 21 to swing the projection 24 free of the lug 25, allowing the clutch element 26 to connect the shaft and flywheel and to cause an operating cycle of the press.

Since the safety valve 40 shuts off the air supply for the cylinder 20 and bleeds it when the main motor 12 has been stopped, it is therefore impossible for the cylinder 20 to operate during this time to connect the ram actuating shaft 18 to the flywheel. As a result, accidents which might be caused by the unexpected descending of the ram where this connection is possible are effectively prevented from happening. In addition, the interlocking of the auxiliary valve system to prevent the opening of the pilot valve 38 until the work holder 16 has reached its proper position and the two-hand requirement for operating the press are further protection against injury to the operator or to the machine.

Although applicant's safety device has been described with particular reference to punch presses, such as the one shown in Fig. 1, it is of course not limited thereto but is of equal application to any ram-type machine actuated by a tripping mechanism.

It is to be understood that the above described arrangements are simply illustrative of the application of the principles of the invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

In a punch press including a tool driving shaft, a flywheel, a motor for driving the flywheel, a circuit including a control switch for supplying power to the motor, a one revolution type clutch normally tending to connect the shaft to the flywheel, an actuable latch normally holding the clutch in disengaged position, a main fluid line, a fluid operable unit connected in the line for moving said latch to free the clutch to connect the shaft and the flywheel, a normally closed valve in the fluid line for controlling the unit and manually actuable means for opening the valve, means for preventing operation of the unit when power is not being supplied to the motor comprising a three-way valve interposed in the fluid line between the normally closed valve and the unit and having aligned supply ports and an exhaust port, said three-way valve being normally operated to close the supply ports and open the exhaust port to the unit, and solenoid means for the three-way valve included electrically in said circuit and energized when said switch is closed to actuate the three-way valve to close the exhaust port and open the supply ports.

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