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SWITCHLESS SAFETY ARRANGEMENT FOR PRESSES

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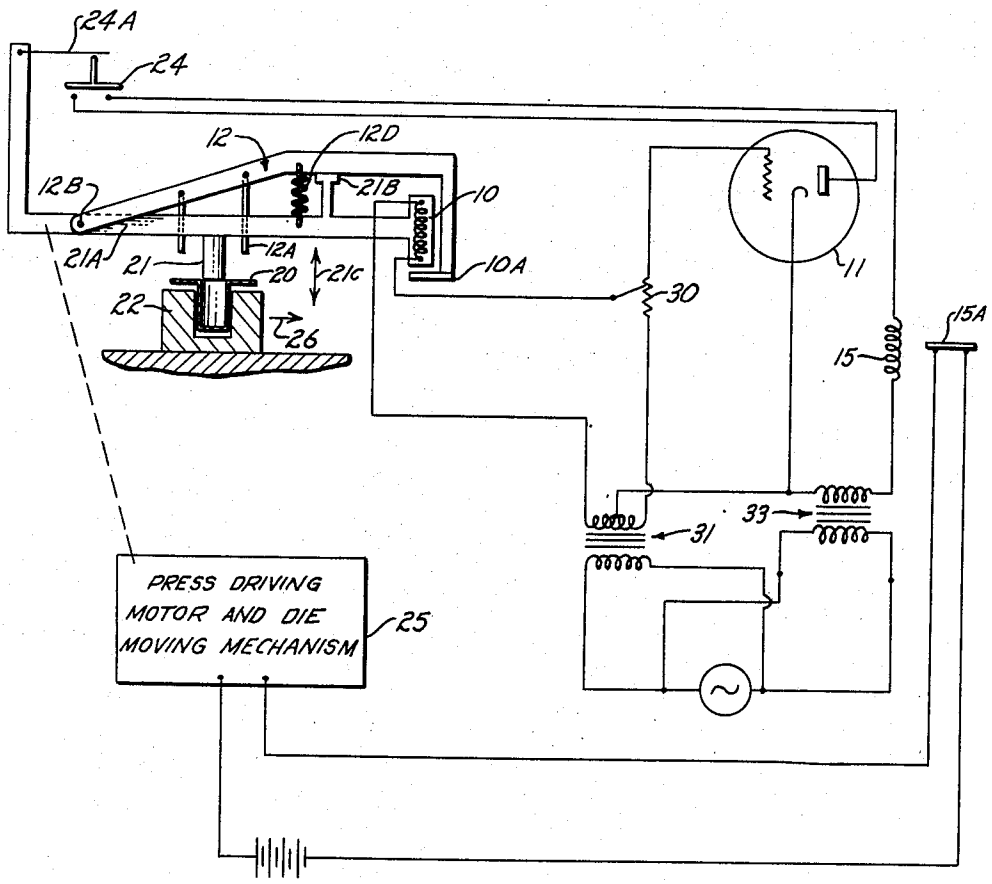


FIG. 1

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SWITCHLESS SAFETY ARRANGEMENT FOR PRESSES

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The present invention relates to an improved safety arrangement particularly useful, but not limited to, use with presses to protect the die members thereof.

In mass production of articles fabricated with presses, a considerable expense is involved in the manufacture and maintenance of the die members arranged to fabricate the different articles. Also, such die members require a relatively long period of time to manufacture by highly skilled toolmakers. In the event that the die members become damaged in use, the presses remain idle for a considerable period of time during which the activities of press operators and other personnel is interrupted.

It is therefore important that the die members be protected from damage.

Usually the die members are harmed due to the failure of the fabricated article to move from the die member after an operation has been performed thereon by such die member; in such case, the next succeeding article fed to the same die member, being stacked on the first article, results in damage to the die member for such die members are intended to accommodate articles of, for example, predetermined thickness only.

In the past, in order to disable the press when such stacking of articles between die members occurs to prevent resulting damage to such die members, micro switches and the like have been placed adjacent the article and arranged to be actuated to disable the press when such stacking occurs; for example, when an article is not correctly positioned with respect to the die members.

Such switches, although satisfactory for a relatively short period of time, are subject to become out of order, since, as is usual, such article is normally coated with a thin coat of oil, a portion of which may eventually flow or seep to the adjacent switch to serve ultimately as a carrier of dirt and foreign particles with the ultimate result that such switches fail in a relatively short period of time.

It is therefore one of the important objects of the present invention to provide an improved safety arrangement for presses characterized by the fact that the control element for disabling the associated press is switchless in character.

Another object of the present invention is to provide an improved safety arrangement for presses, adapting for that purpose a novel control circuit of longer life than other circuits used heretofore for the same purpose.

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Another object of the present invention is to provide an improved safety arrangement for presses characterized by the rugged nature thereof for assuring continued operation of the press for a longer period of time.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. This invention itself, both as to its organization and manner of operation, together with further objects and advantages thereof, may be best understood by reference to the following description taken in connection with the accompanying drawing in which the figure is a schematic representation of the electrical and mechanical elements of a system embodying features of the present invention.

Referring to the figure, a solenoid coil 10 is connected in a phase shifting circuit in the grid circuit of a thyratron type of tube 11. The solenoid 10 has associated therewith a movable core member 10A which is mounted on an operative member 12 of the press, the member 12 being in a predetermined position spring biased against the stop 21B when a work piece 20 is properly positioned between the die members 21, 22. In the event that the work piece 20 is not properly positioned, the phase of the voltage to the control grid of the thyratron tube 11 is such that the tube 11 fires (when simultaneously switch 24 is closed) to energize the relay winding 15. This relay winding 15, in turn, controls the energization of the motor 25 driving the press. Or, such switch 15A associated with relay winding 15 may effect energization of other control elements such as brakes, clutches, etc., for the same intended purpose of stopping movement of the die member 21 in the event of faults occasioned by improper positioning of work pieces between the die members 21, 22.

The mechanical arrangement shown in schematic form is merely exemplary of others of similar character which may be used.

In the figure the members 12A are in the form of a "knock-out die" arranged to remove a work piece 20 from the die member 21 after an operation has been performed thereon by such die member 21. The die member 22, cooperating with the die member 21, remains stationary but the piece 20 formed therebetween is automatically moved to an adjacent station by conventional means not shown in the direction indicated by the arrow 26. In order to prevent sticking of such piece 20 to the die member 21, with subsequent resulting damage to the die member

21, due to stacking of pieces 20 between dies 21 and 22, the knock-out die 12A is provided. It is noted that the member 12 is pivoted at 12B to the die supporting structure 21A which is movable vertically as indicated by the arrow 21C; and the knock-out die members 12A are in the form of fingers passing through enlarged apertures in member 21A and arranged to engage the annular flange on piece 20 when the die member 21 rises to shed the piece 20 from die 21. These members 12A are pivoted to the member 12.

This knock-out die member 12 is spring loaded by tension spring 12D and acts to remove the work piece from the die member 21 after a forming operation produced thereby in the event that such work piece tends to stick to the die 21. In other words, the strength of the spring 12D associated with such knock-out die 12A is normally effective to produce such dislodgement or shedding of the piece 20 from the die member 21. In abnormal situations, wherein the work piece 20 remains affixed to the die member 21, the spring 12D associated with the knock-out die is not sufficiently strong to dislodge the work piece 20, with the result that the knock-out die member 12 assumes a position different from its normal position.

In the normal operation of the press, the knock-out die member 12 is spring biased against the stop 21B when the die 21 is approximately near the end of its vertical or forward travel at which time the switch 24 is automatically closed. It is noted that the core member 10A is mounted to move in accordance with the movement of the knock-out die member 12 while the solenoid 10 is relatively stationary with respect thereto and mounted on member 21A.

In the normal operation of the press, the core member 10A thus assumes a position with respect to the solenoid 10 to prevent firing of the tube 11; but in abnormal operation corresponding to the situation wherein the knock-out die members 12A still contact a work piece stuck on the die member 21 when the member 21A is approximately near the end of its vertical or upward travel to effect closure of switch 24, the core member 10A is more closely spaced to the solenoid 10 to effect firing of the tube 11. It is noted that such solenoid 10 and movable core 10A are physically closely associated to the die members 20, 21, and that its operation, and the life of its operation, is effected in relatively small degree by oil from the pieces 20 seeping over to the solenoid 10.

The switch 24, preferably of the micro switch type having a flexible actuating arm 24A operated in synchronism with movement of the main die 21, may be located at positions remote from the die members 21, 22 themselves to avoid the seeping of oil thereto. In presses having a plurality of punching or forming stations, only one switch 24 may be necessary in each one of the anode circuits of corresponding tubes 11.

The thyratron tube 11 has its control grid connected to the junction point of solenoid winding 10 and bias resistance 30, the other terminals of the winding 10 and resistance 30 being connected respectively to opposite terminals of the secondary winding of biasing transformer 31, the center tap of such secondary winding being connected to the cathode of device 11 and to one terminal of the secondary winding of the plate transformer 33. The other terminal of such secondary winding of transformer 33 is connected to the anode of the device 11 through the serially connected relay winding 15 and normally open switch 24.

It is noted that only alternating current operating potentials are applied to the elements of device 11, and that the firing of device 11 depends upon the phase of the voltage on the control grid with respect to the phase of the voltage on the anode. This phase difference is controlled in accordance with the position of the movable armature 10A. As outlined hereinabove, in the normal position of the core member 10A with the member 12 in engagement with stop 21B, the tube 11 is incapable of being fired; but when work pieces are improperly positioned with respect to the die member 21, as, for example, when such pieces tend to stack between the die members 21, 22, the core 10A is improperly positioned, with the result that the tube 11 is fired to cause an energizing current to flow through the winding 15. When such winding 15 is energized, the normally closed contacts 15A of the associated relay are opened to effect de-energization of the motor 25 driving the press associated with the die members 21, 22.

While the particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from this invention in its broader aspects and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of this invention.

I claim:

1. A safety arrangement for presses comprising: a first member movable in accordance with movement of a die member, a second member normally movable to a predetermined position in normal operation of the press but arranged to assume a position other than said normal position when said die member is likely to become damaged, a gaseous discharge device having a control grid and an anode, a source of voltage, a connection extending from said source to said anode for the flow of space current to said device, a first control circuit incorporating said gaseous discharge device change is arranged to fire in accordance with the differences in phase shift between its control grid and its anode, said first member being arranged to periodically open and close said connection to said anode, and said second member being arranged to control the phase of the grid of said device with respect to its anode in accordance with the position of said second member, and a second control circuit associated with said anode circuit to disable said press when said tube is fired.

2. A safety arrangement for presses comprising: a pair of die members, means arranged to move one of said die members, a discharge device having a control grid and an anode, means controlling said die moving means in accordance with current flowing through said discharge device, means arranged to vary the relative phase of the voltage between the control grid and the anode of said discharge device to vary the current flowing therethrough, the last mentioned means comprising a member movable in accordance with the incorrect positioning of an article between said die members, and means operated in timed relationship with said one die member for interrupting the flow of current to said discharge device.

3. A safety arrangement for presses comprising: a first member movable in accordance with

the movement of a die member, a second member normally movable to a predetermined position in operation of the press, but arranged to assume a position other than said normal position when said die member is likely to become damaged, a discharge device having a control grid and an anode, a first control circuit incorporating said discharge device energized in accordance with difference in phase shift between voltages delivered to its control grid and its anode, means whereby said second member is arranged to control the phase of the voltage on the grid of said device with respect to the voltage on its anode in accordance with the position of said second member, a second control circuit associated with said anode circuit to disable said press in accordance with current flow through said discharge device, and means operated in timed relationship with said first member for interrupting the flow of current to said discharge device.

4. A safety arrangement for presses comprising cooperating die members arranged to perform an operation on an article, means sensitive to correct positioning of said article, die moving means, a gaseous discharge device having a control grid and an anode, a control circuit including said discharge device and said die moving means for controlling said die moving means in accordance with phase differences of voltages on the control grid and anode of said discharge device, means whereby said first mentioned means is operative to control the phase difference between the voltages of said control grid and said anode, means sensitive to the phase difference between said voltages of the said control grid and said anode for disabling said die moving means, and means operated in timed relationship with said die moving means for interrupting the flow of current to said anode.

5. A safety arrangement for presses comprising: cooperating die members arranged to perform an operation on an article, means sensitive to correct positioning of said article, die moving means, a gaseous discharge device having a control grid, an anode and controlling said die moving means in accordance with phase differences of voltages on the control grid and anode of said discharge device, said discharge device having a cathode, a variable inductance connected in the grid and cathode circuit of said discharge device, said first mentioned means being operative to vary the amplitude of said inductance to thereby vary the relative phase difference between the voltage on said control grid with respect to the phase of the voltage on said anode, and a control circuit responsive to current flow to said anode connected to disable said die moving means, and means operating in timed relationship with said die moving means for interrupting the flow of current to said anode.

6. A safety arrangement for presses comprising: a first die member, a first inductance element mounted on said die member, a knock-out die member, means movably mounting said knock-out die member with respect to said first die member, a second inductance element, means stationarily mounting said second inductance element with respect to said knock-out die member, a gaseous discharge device having a cathode, a control grid and an anode, a control solenoid, a control switch, means connecting said control solenoid and control switch serially with said anode, means periodically operating said control switch in timed relationship with operation of said first die member, said first and second inductance elements being magnetically interrelated to form a variable inductance unit which is variable in magnitude in accordance with the relative spacing of said inductance elements, a source of alternating current connected between said anode and said cathode, a source of alternating current connected between said control grid and said cathode, and means including said inductance unit for controlling the relative phase of the alternating current appearing on said anode and control grid in accordance with the relative position of said inductance elements.

7. Circuitry for use in presses for preventing damage to die members, a gaseous discharge device having a cathode, a control grid and an anode, a first inductance element, a second inductance element magnetically cooperating with said first inductance element to form an inductance unit, a control solenoid, a control switch, a first source of alternating current, a first serial circuit comprising said first source, said control solenoid, said control switch, said anode and said cathode; a second source of alternating current, a second serial circuit including said second source of alternating current, said inductance unit, said control grid and said cathode, means for recurrently operating said control switch, and means for movably mounting one of said inductance elements with respect to the other inductance element.

8. The arrangement set forth in claim 7 in which said means for recurrently operating said control switch comprises die moving means, and wherein one of said inductance elements is stationarily mounted with respect to a first die member and the other one of said inductance elements is mounted on a knock-out die member which is movably mounted with respect to said first die member.

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