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SAFETY ARRANGEMENT FOR PRESSES

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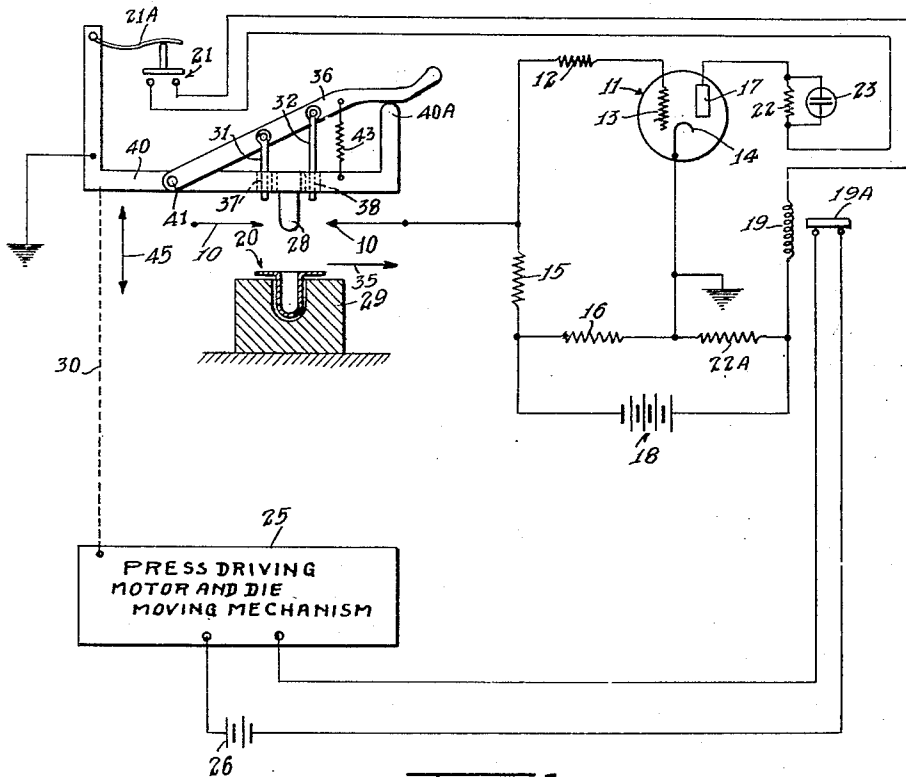


Fig 1

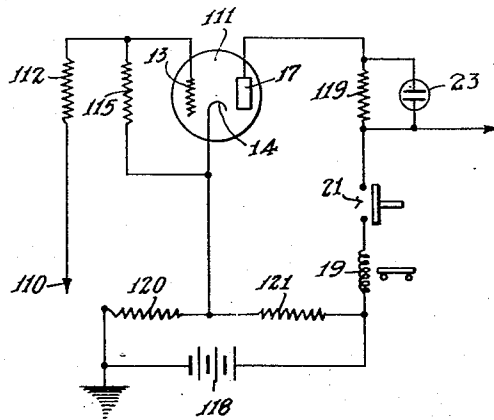


Fig 2

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## SAFETY ARRANGEMENT FOR PRESSES

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8 Claims. (Cl. 192—125)

1

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 maintained 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 articles 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 in the nature of small probes in the nature of "cat whiskers."

Another object of the present invention is to provide an improved safety arrangement for presses, adapting for that purpose novel control circuits.

2

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 drawings in which:

Figure 1 is a schematic representation of the electrical and mechanical elements of a system embodying features of the present invention.

Figure 2 is a schematic representation similar to that in Figure 1 showing a modified arrangement.

Referring to Figure 1, a probe 10 in the form of a "cat whisker" is connected in the grid circuit of a thyratron type of tube 11. The probe 10 may comprise one or more in number and may be radially disposed, if desired, with the inner tips of such assembled probes defining a circle through which the article 20 may pass. Such probes 10 are interconnected and connected through resistance 12 to the control grid 13. The control grid 13 is connected to its associated cathode 14 through the serially connected resistances 15 and 16.

The anode 17 of device 11 is connected to the positive terminal of voltage source 18 through the relay winding 19, normally open switch 21 and indicating resistance 22 having connected in shunt thereto the gaseous type of indicator 23, the negative terminal of voltage source 18 being connected to the junction point of resistances 15 and 16, and the positive terminal of source 18 being also connected to the cathode 14 through the resistance 22A, to thereby cause a current to normally flow through the serially connected resistances 16, 22A.

Such normal current flow through the resistance 16 from source 18 results in the grid 13 being negative with respect to the grounded cathode 14; consequently, the tube 11 normally is prevented from firing even though the switch 21 is closed.

However, in the event that the work piece 20 is not properly positioned and contacts one of the cat whiskers 10, while simultaneously the switch 21 is closed, the junction point of re-

sistances 12, 15 is grounded to cause the tube 11 to "fire," to thereby energize the relay winding 19 to open its associated normally closed switch 19A. This relay winding 19, and associated switch 19A controls the energization of the press driving motor and die moving mechanism 25, which is normally energized with current from the voltage source 26 serially connected with the switch 19A; or such switch 19A associated with relay winding 19 may effect energization of other control elements such as brakes, clutches, etc., for the same intended purpose of stopping movement of the die member 28 in the event of fault occasioned by improper positioning of work pieces between the die members 28, 29.

The mechanical arrangement shown in schematic form is merely exemplary of others of similar character which may be used, and the mechanical connection between the die moving mechanism 25 and the die member 28 is indicated by the dotted line 30.

In Figure 1 the members 31, 32 are in the form of a "knockout die" arranged to remove a work piece 20 from the die member 28 after an operation has been performed thereon by such die member 28. The die member 29, cooperating with the die member 28, remains stationary, but the work piece 20 formed therebetween is automatically moved to an adjacent station by conventional means not shown, in the direction indicated by the arrow 35. In order to prevent sticking of such piece or article 20 to the die member 28, with subsequent resulting damage to the die member 28, due to stacking of a plurality of pieces or articles 20 between dies 28 and 29, the knockout dies 31, 32 are provided. It is noted that such knockout die members 31, 32 are pivotally mounted at their upper ends on the knockout die lever 36, with such knockout die members 31, 32 passing through guide apertures 37, 38 in the die holding member 40. Lever 36 is pivotally mounted at 41 to the member 40 and is normally biased against the stop member 40A by the coil tension spring 43. It is noted that the die member 40 is movable vertically, as indicated by the arrows 45; and the knockout die members 31, 32 are in the form of fingers arranged to engage the annular flange on piece 20 when the die member 28 rises to shed the piece 20 from die 28. When the die member 28 is moved into its lowermost position in cooperation with the die member 29, the knockout die fingers 31, 32, when they contact the flange of the article 20, move upwardly with respect to the die holding member 40; but, after a forming operation such spring biased fingers 31, 32 tend to remove the article from the die member 28 in the event that such article tends to stick to such die member 28.

In other words, the strength of the spring 43, associated with such knockout die fingers 31, 32 is normally effective to produce such dislodgement or shedding of the piece 20 from the die member 28. In abnormal situations, wherein the work piece 20 remains affixed to the die member 28, the work piece 20 is carried upwardly with the die member 28 into contact with one or more of the circularly or radially disposed cat whiskers 10 to thereby ground such cat whiskers or probe, to condition the tube 11 for firing. It is noted that the die member 28 and the die holding member 40 is grounded.

Optionally, the firing of the tube 11 may be made independent upon the position of the die member 40, as for example, by disposing the normally open micro switch 21 in such position

with respect to the die holding member 40 that such switch 21 is closed only when such article 20 is opposite the cat whisker 10 in the abnormal situation described hereinabove. In such optional arrangement, the micro switch 21 is closed only when the die holding member 40 is approximately near the end of its vertical or upward travel. It is noted that the safety arrangement described may be operated with the switch 21 closed at all times. The micro switch 21 is actuated by the flexible arm 21A having one of its ends mounted on the die holding member 40.

Once the device 11 is fired in the manner described hereinabove, by contact of the grounded article 20 with one of the cat whiskers 10, a relatively high voltage is developed against the resistance 22 to produce illumination from the indicating lamp 23 to effect an indication.

In the modified arrangement shown in Figure 2, the thyatron tube 111 is arranged to be fired to effect energization of the corresponding relay 19 when the cat whisker 110 (corresponding to the cat whisker 10) does not engage the work piece. In other words, the circuit shown in Figure 1 is intended to interrupt operation of the mechanism 25 when an article is improperly positioned between the die members 28, 29, while similarly the circuit shown in Figure 2 is intended to accomplish the same result in response to the absence of contact between the article 20 and the cat whisker 110. In other words, the circuit shown in Figure 1 is responsive to the making of contact between an article and a cat whisker, and the circuit shown in Figure 2 is responsive to the absence of contact between a cat whisker 110 and an article.

In each case, such probes 10, 110 serve as a current conductor, and when they make contact with the work piece, the work piece serves as a return circuit for electric current, which consequently flows to cause deenergization of the mechanism 25.

Of significance is the fact that the contact resistance between any one of the probes 10, 110, on the one hand, the work piece 20, on the other hand, may vary considerably in accordance with the manner in which the probe might engage the work piece, and such contact resistance, might indeed be high and vary over a considerable range, since the work piece 20 is usually covered with an oil film to facilitate its forming or shaping by the die member 28, 29. In both circuits shown in Figures 1 and 2 it is noted that the corresponding probe 10, 110 is serially connected with a very high resistance in the grid circuit of the associated discharge device, whereby the overall percentage variation in resistance is relatively small even though the contact resistance may vary appreciably over a wide range.

In Figure 2, the control grid 13 is connected to the probe 110 through the resistance 112. Also, such grid 13 is connected to the cathode 14 through resistance 115. The anode 17 is connected to the positive terminal of voltage source 118 through the serially connected indicating resistance 119, switch 21 and relay winding 19, the other terminals of source 118 being grounded. The cathode 14 is grounded through the resistance 120, and is connected likewise to the positive terminal of source 118 through the resistance 121, with the result that a current normally flows through the serially connected resistances 120, 121 to raise the potential of the cathode 14 with respect to ground.

When a grounded work piece engages the cat

5

whisker 110, the grid 13 is effectively grounded through the resistance 112 to prevent firing of the tube 111; but, in the absence of a grounded work piece in engagement with the probe 110, the tube 111 will fire because the grid 13 is substantially at cathode potential or somewhat more positive than cathode potential because of the flow of grid current through resistance 115.

It is noted that corresponding elements in Figures 1 and 2 have identical reference numbers.

In Figure 1, resistance 12 is a grid current limiting resistance and may be in the order of 100,000 ohms. Resistance 15 may be in the order of 2 megohms. Resistance 16 may be in the order of 8,000 ohms, and resistance 22A may be in the order of 20,000 ohms.

In Figure 2, resistance 112 may be in the order of 100,000 ohms. Resistance 115 may be in the order of 2 megohms.

In both Figures 1 and 2, the tube 11 or 111 may be of the General Electric type 2050.

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 having a pair of die members, the subcombination comprising: a cat whisker type of probe disposed in relationship to said cooperating die members for engagement with improperly positioned articles formed by such die members, means arranged to move said die members and means arranged to deenergize said die moving means in accordance with contact of an article with said cat whisker, said last mentioned means comprising a gaseous type of discharge device with a control electrode connected to said cat whisker through a resistance whose magnitude is relatively high with respect to the contact resistance existing between the cat whisker and the article, said die members being substantially at ground potential, said discharge device having a cathode maintained at substantially the same potential as said die members, and means normally biasing said probe negatively with respect to said cathode.

2. A safety arrangement for presses having a pair of die members, the subcombination comprising: a gaseous discharge device having a control electrode, a cathode and an anode, means arranged to move said die members relative to one another, said die moving means being controlled in accordance with current flowing through said discharge device, a cat whisker type of probe associated with said die members for engagement with an improperly positioned article, said control electrode being normally connected negatively with respect to said cathode to normally prevent said discharge device from firing, said control grid being connected to said cathode through a resistance network, and said probe being connected to an intermediate point on said resistance network to effect firing of said discharge device, and means normally maintaining said die members and said cathode at substantially the same potential.

3. A safety arrangement for presses having a pair of cooperating dies, the subcombination comprising: means arranged to move said dies relative to one another, a gaseous discharge de-

6

vice controlling said die moving means in accordance with current flowing through said discharge device, a cat whisker type of probe arranged to engage an article formed by said dies, said discharge device having a control element, and said probe being connected to said control element through a resistance relatively high in comparison with the contact resistance developed by the said probe and the article formed by the dies, said dies being normally maintained substantially at ground potential, said discharge device having a cathode, means maintaining said cathode and dies substantially at the same potential, and means normally maintaining said control element at a potential negative with respect to said cathode.

4. A safety arrangement for presses having a pair of cooperating die members, the subcombination comprising: a cat whisker type of probe adapted to be contacted by an article formed by said die members when said article is improperly positioned between said die members, a gaseous discharge device having a control grid, a cathode and an anode, a resistance network connected between said control grid and said cathode to maintain said grid normally negative with respect to said cathode, said probe being connected to an intermediate point on said network, means arranged to move said die members, and means controlling said die moving means in accordance with the current flow to said anode, and means normally maintaining said die members at substantially the same potential as said cathode.

5. A safety arrangement for presses having a pair of die members, the subcombination comprising: a gaseous discharge device having a control grid, a cathode and an anode, a cat whisker type of probe adapted to contact an article formed by said die members when said article is incorrectly positioned between said die members, said probe being connected to said control grid through a resistance relatively high in comparison to the contact resistance developed between said article and said probe, a grid leak resistance connected between said control grid and said cathode, means normally maintaining said cathode positive with respect to ground, means arranged to ground said article when it is so incorrectly positioned, means arranged to move said die members to produce an operation on said article, said last mentioned means being controlled in accordance with the current flowing to said anode.

6. A safety arrangement for presses having a pair of die members, the subcombination comprising: means arranged to move said die members, a cat whisker type of probe positioned to contact an article operated upon by said die members when said article is in a predetermined position with respect to said die members, a discharge device having a control electrode, said control electrode being connected to said probe through a resistance which is relatively high in comparison to the contact resistance developed between said probe and said article, and means controlling said die moving means in accordance with the current flow through said discharge device, said discharge device having a cathode normally maintained at substantially ground potential, means maintaining said die members at substantially the same potential as said cathode, and means normally maintaining said control electrode at a potential commensurate with the potential of the cathode to pro-

7

duce a relatively small normal current flow through said discharge device.

7. A safety arrangement for presses comprising: a gaseous discharge device having a control electrode, a cathode and an anode, a pair of co-operating die members, means arranged to move said die members relative to one another; said die moving means being controlled in accordance with current flowing from said anode of said discharge device in an anode circuit extending between said anode and said cathode, a cat whisker type of probe associated with said die members for engagement with an improperly positioned article, said control electrode being normally connected negatively with respect to said cathode to normally prevent said discharge device from firing; said control electrode being connected to said cathode through a resistance network, and said probe being connected to an intermediate point on said resistance network to effect firing of said discharge device, and a switch in said anode circuit actuated upon movement of said die moving means, said switch normally preventing the flow of current in said anode circuit and being automatically closed upon relative movement of said die members towards one another.

8. A safety arrangement for presses having a pair of dies, the subcombination comprising:

8

means arranged to move said die members, a cat whisker type probe positioned to contact an article operated upon by said die members when said article is in a predetermined position with respect to said die members, a discharge device having a control electrode, a relatively high resistance, said control electrode being connected to said probe through said resistance which is relatively high in comparison to the contact resistance developed between said probe and said article, means controlling said die moving means in accordance with the current flow through said discharge device, said last mentioned means being sensitive to the relative position of said probe with respect to said predetermined position of said article.

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