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SHEET DETECTOR FOR PRINTING PRESSES

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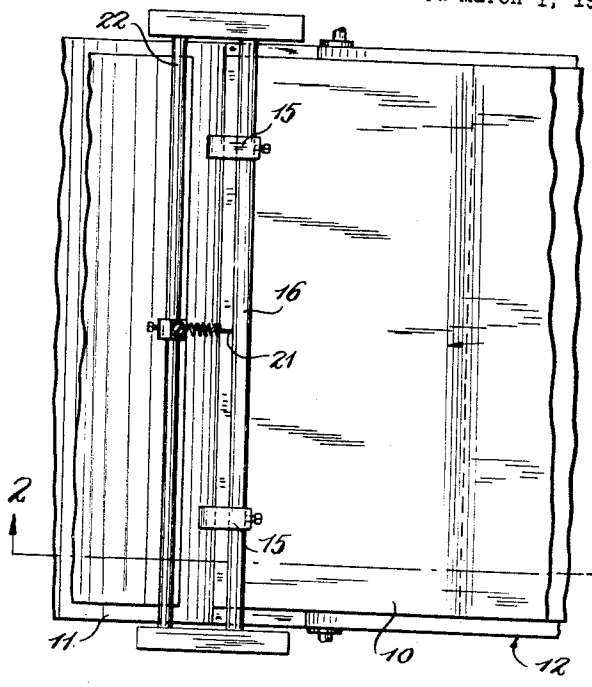


FIG. 1

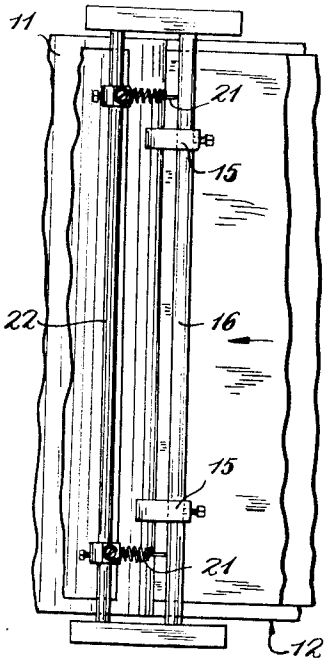


FIG. 4

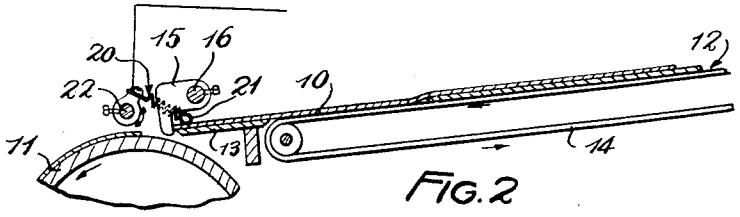


FIG. 2

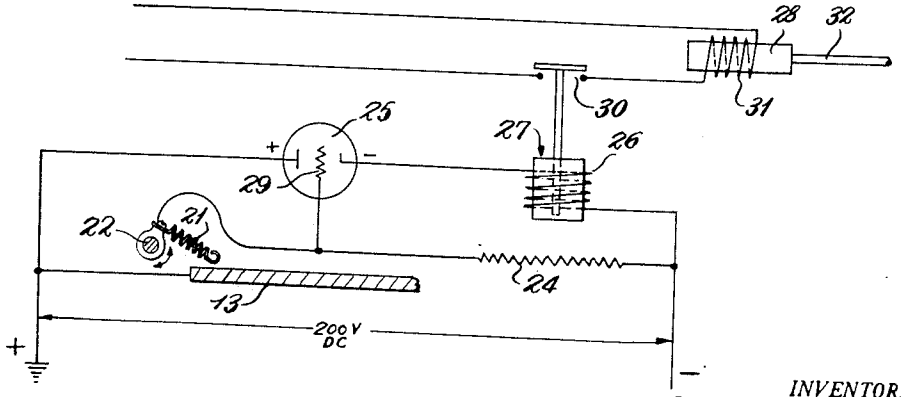


FIG. 3

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SHEET DETECTOR FOR PRINTING PRESSES

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5 Claims. (Cl. 317—149)

The present invention relates to detectors for use with machines, particularly printing presses, which perform an operating on a non-conducting material, such as a sheet of paper, to determine the presence or absence of the non-conducting material and, more particularly, to an electrical detector for use with a sheet feeder for delivering sheets from a pile and representing them individually in succession to the machine to determine whether or not a sheet of material has been properly delivered.

Many machines, especially printing presses, include in combination therewith sheet feeders for delivering an individual sheet of material, such as a sheet of paper or cardboard, from a pile of sheets to a feed position in registry with guide means from which the sheet is to be fed into the machine or press. In the case of printing presses, the sheets are either fed in underlapped relation or fed sheet by sheet to the above-mentioned feed position, and if a sheet is not delivered to the feed position, or is not delivered in proper relationship with respect thereto, it is a sign of possible malfunctioning of the sheet feeder and it is desirable that the printing press or other machine be stopped and the condition causing the malfunctioning remedied.

The principal object of the present invention is to provide in a printing press a new and improved electrical sheet detector for determining whether or not a sheet has been delivered by a sheet feeder into position for feeding into the press and to perform a control function such as stopping the operation of the feeder and throwing off pressure between printing cylinders if the sheet has not been properly delivered, the detector being so constructed and arranged that it operates at a sufficiently high voltage to overcome contact resistance at the detector point but yet does not present a danger or hazard to operating personnel.

Another object of the present invention is to provide in a printing press, or similar machine, a new and improved detector for determining the presence or absence of non-conductive material, which detector comprises conductive members which are adapted to engage opposite sides of the non-conducting material so as to be insulated from each other and which are movable into contact with each other when no material is therebetween, the detector being so constructed and arranged that while operating with a sufficiently high voltage at the detector point to overcome contact resistance at the point, the current flowing in any short circuit caused by the operator or other person touching an exposed part, or parts, of the detector will be of such a small magnitude that the person receives little and, preferably, no sensation of shock.

A further object of the present invention is to provide a detector for detecing the presence or absence of a non-conductive material being operated upon by a machine such as a printing press in which two conductive members are separated by the non-conductive material when the latter is present and engageable with each other when the material is not in its proper position, the conductive members being connected in series with a source of potential which provides a relatively high voltage drop across conductive members when separated and with a current limiting means which limits the current flowing in a circuit containing the conductive members or one of the conductive members to a value which is incapable of causing a noticeable shock to operating personnel or others.

A further object of the present invention is to provide a detector as set forth in the above objects which includes electric control means responsive to current flowing in the detecting circuit for causing the operation of relay means to perform a control operation, such as an interruption of printing or the stopping of the feeder or other machine with which the detector is being used.

A further object of the present invention is to provide, in combination with sheet feeders for printing presses, a sheet detector in which conductive members are normally prevented from moving into engagement with each other by a sheet to be presented to the machine by the feeder and which are engageable with each other when the sheet has not been delivered properly by the sheet feeder, and in which a voltage is established across the two conductive members, when the latter are separated, which is sufficient upon engagement of the conductive members to break down the resistance of dirt, or other material, which collects on the conductive members during the normal operation of the machine, the detector, however, being so constructed and arranged that the presence of the high voltage on the conductive members does not constitute a hazard to operating personnel.

Further objects and advantages will be apparent from the following description of the preferred embodiment of the present invention made with reference to the accompanying drawings forming a part of this specification, in which:

Fig. 1 is a fragmentary plan view of a sheet feeder and a printing press having in combination therewith a sheet detector embodying the present invention;

Fig. 2 is a fragmentary sectional view taken approximately along line 2—2 of Fig. 1;

Fig. 3 is a schematic electrical diagram showing the operation of the detector; and

Fig. 4 is a fragmentary plan view of an alternative form of the present invention.

While the present invention is susceptible of various modifications and arrangements and of embodiment in various types of machines, it is herein shown and described as embodied in a printing press having a sheet feeder in combination therewith.

Referring to the drawings, sheets of paper or other material, designated by the reference numeral **10**, are fed to the cylinder **11** of a printing press by a sheet feeder **12**. The cylinder **11** may be an impression cylinder of a printing couple or a feed cylinder which subsequently passes sheets to the impression cylinder. In either case, the cylinder carries gripper fingers (not shown). These fingers may be what are commonly termed tumbler grippers in the printing art, in which case they grip a sheet at rest on a feed table **13** and carry it into the press. Or, they may be used in combination with conventional feed roll mechanism which drives the sheet to the grippers. The sheet feeder **12**, in the illustrated embodiment, is adapted to deliver from a pile of sheets, not shown, sheets of material in underlapped fashion or sheet by sheet with a space between them to a position from which they move onto the cylinder **11**; and since the structure of the sheet feeder is conventional, it will not be shown or described in detail. The particular manner of delivering sheets from the pile to the machine is immaterial to the invention, and the word "stream" will

be used in the remainder of the specification and claims to depict any suitable method of delivering the sheets in succession from the pile of sheets to a feed position from which they move in timed relationship to the operation of the machine. The sheet feeder 12 comprises a feed table 13 which terminates adjacent to the cylinder 11, and tapes 14 engageable with the underside of the sheets to be transferred to move the individual sheets successively into engagement with a pair of front stops or guides 15 at the exit end of the table 13 adjacent to the cylinder 11. The front stops or guides 15 stop the individual sheet 10 in proper position and registry for the latter to be fed to the cylinder 11 in timed relationship to the operation of the press and the stops are mounted on a rockshaft 16 supported above and extending transversely of the table 13. The shaft 16 is rockable to move the stops 15 to a position for stopping and registering the sheets 10 and to a clear position to permit feeding of the sheets to the cylinder 11.

In accordance with the present invention, an electrical sheet detector 20 is provided to determine whether or not a sheet has been properly delivered against the stops 15 so as to be in position for transfer to the cylinder 11. The sheet detector includes two electrically conductive members which are moved into engagement with each other to complete a control circuit each time a sheet is not in the feed position at a predetermined time. In the preferred and illustrated embodiment, the sheet detector 20 comprises an electrically conductive spring finger 21. The finger 21 is mounted on a rockshaft 22 and is rocked from a position clear of the table and the sheets thereon into engagement with the feed table 13 or the sheet 10 supported thereon in timed relation to the operation of the press. The movement of the rockshaft 22 is such that the finger 21 is moved toward engagement with the feed table 13 each time a sheet 10 is, if the sheet feeder is operating properly, positioned against the stops 15. If the sheet has been delivered against the stops 15, the presence thereof will prevent the finger 21 from contacting the feed table 13. If, however, the sheet feeder has not delivered a sheet when the finger 21 moves toward table 13, the finger will engage the table. Preferably, the finger 21 is rocked downwardly into momentary contact with the table 13 or the sheet thereon to sense the presence or absence of the sheet and then is rocked upwardly so that it does not interfere with the movement of the sheet from the feed table to the cylinder. Since the finger 21 is a light spring finger, it will not interfere with the movement and the registering of the sheets 10.

If a sheet is not in its proper position against the guides or stops 15 when the finger 21 is rocked toward the feed table 13, the finger will engage the feed table and a current will flow in a series circuit comprising the feed table 13, the finger 21, and a current limiting resistance 24. To this end, the feed table 13 is connected to one side of a power supply, preferably a direct current supply as shown in the illustrated embodiment, and the finger 21 is connected to the other side of the supply through the current limiting resistance 24. The voltage of the power supply is sufficiently high to assure that the contact resistance between the table and the finger due to oil, dirt, paper dust, and the like, will be broken down when the finger 21 engages the feed table 13 so that the necessary current will flow. Preferably, the voltage between the table and the finger 21, when separated, is approximately 200 volts.

The current limiting resistance 24 is of such a magnitude that it limits the current flowing through the feed table 13 and the finger 21 when the two are in engagement to a magnitude which is incapable of producing a noticeable shock when flowing in the human body at the voltage involved. By limiting the current to such a small magnitude, an operator who causes a short circuit between the finger 21 and the feed table 13 when the finger and table are not in engagement with each other will receive little and, preferably, no sensation of shock thereby eliminating the danger of injury directly due to a large electrical current and also the danger of an involuntary movement due to a shock. A reaction to an electrical shock, such as a quick jerking movement, constitutes a hazard around any operating machinery which has exposed moving parts, as is true in the case of printing presses.

In the illustrated embodiment, the current flowing through the current limiting resistance 24 controls the operation of a vacuum tube which functions as an electronic switch. As shown in Fig. 3, the positive side of the power supply is preferably connected to the feed table 13, and the resistance 24 has one side connected to the finger 21 and the other side connected to the negative terminal of the power supply. A vacuum tube 25 has its plate connected to the positive side of the power supply and its cathode connected to the negative side of the power supply through a coil 26 of a relay 27 which controls the flow of current to a solenoid 28. The vacuum tube 25 has a control element or grid 29 which is connected to the finger 21 and which is driven positive when a circuit is completed by the engagement of the finger 21 and the feed table 13. In the absence of a current flowing in the resistance 24 to bias the grid positive, the current flowing through the vacuum tube 25 is of too small a magnitude to energize the relay coil 26 sufficiently to operate the relay 27. However, when the finger 21 contacts the table 13, the grid 29 is driven sufficiently positive to cause a current to flow in the coil 26, which current is of sufficient magnitude to operate the relay 27 and close its normally open contacts 30. Thus, it can be seen that the tube 25 functions in the manner of a switch for the relay 27. The closing of the normally open contacts 30 complete a circuit for energizing the solenoid 28, and the energization of solenoid 28 causes the reciprocation of a link 32 connected to the tripping mechanism of the press to stop the operation thereof.

Preferably, the normal condition of the vacuum tube 25 is such that, with no current flowing through the finger 21, a small or trickle current flows through the relay coil 26. The relay coil 26 then acts as a stabilizer to compensate for variations in supply voltage. The trickle current flowing in the coil 26 tends to drive the grid 29 negative with respect to the cathode of the tube 25 and, if the supply voltage drops, the grid 29 will become less negative with respect to the cathode lowering the resistance of the tube 25 to compensate for the drop in the supply voltage. If the supply voltage increases, the increase in current flowing in the coil 26 will drive the grid 29 more negative causing the impedance of the tube 25 to increase and once again compensating for the change in supply voltage. The action of the coil 26 makes the detector substantially independent of supply voltage fluctuations over a wide range. Of course, the normal current flowing through the coil 26, in the above-described circuit, is insufficient to operate the relay 27.

While the preferred embodiment of the present invention has been described as using a single detector finger for detecting the absence or presence of a sheet, two fingers 21 can be utilized to detect the misalignment of sheets as well as the presence or absence thereof. When two fingers are used, one is placed adjacent one side edge of the feed table 13 and the other adjacent the other side edge of the table, as is illustrated in Fig. 4, and the fingers are connected in parallel with each other so that in the event that either one touches the table 13, a circuit is completed and current flows through the resistance 24.

The invention has been described with reference to a printing press and a sheet feeder therefor, it will be understood, however, that the nature of the detector is such that it may be embodied in other types of machines

for determining the presence or absence of any material which does not conduct electricity between two members in engagement with oposite sides thereof, and that it is also suitable for use in ways other than those specifically set forth, for example, with material which is being fed in a continuous web to detect breakage thereof. It will be further understood that a control circuit can be broken in response to the engagement of the finger **21** with the feed table **13** rather than made as in the preferred embodiment, and modification may be made in the switching circuit which is responsive to the small current flowing in the circuit including the detector finger when the latter circuit is completed. In addition, it will be seen by those skilled in the art that the invention is not limited to the particular manner shown for causing the engagement of two conductive members to complete a circuit when a sheet is not in a particular position at a particular time and that the control circuit can be used with any two conductive members which engage each other upon misdelivery of a sheet.

Preferably the detector finger and the plate and cathode of the tube **25** are connected to a direct current source, however, it can be seen by those skilled in the art, that an alternating current source could be used, in which case the tube **25** would conduct only on alternate half cycles. If an alternating current is applied to the detector finger, two tubes **25** can be utilized to provide full wave response if so desired.

It can now be seen that the present invention provides an extremely simple electrical detector which is safe for operating personnel and which can be readily used to detect the presence or absence of a sheet, as well as misaligned sheets if so desired, and that the objects heretofore enumerated and others have been accomplished.

While the preferred form of the invention has been described in considerable detail, it will be apparent that the invention is not limited to the construction shown or to the uses referred to, and it is my intention to cover hereby all adaptations, modifications, and changes which come within the practice of those skilled in the art to which the invention relates and the scope of the appended claims.

Having thus described my invention, I claim:

1. In a printing press or similar machine for performing an operation on a material and including means for delivering the material to a predetermined position and sensing means for determining whether the material has been properly delivered to said position; the combination comprising two conductive members having a first relative position in engagement with each other and a second relative position spaced from each other, said members obtaining said second relative position when the material is properly delivered and said first relative position when improperly delivered, a control circuit including electronic amplifying means having an input circuit and an output circuit, said output circuit including control means actuatable to effect a control operation and said input circuit including said members and a resistance connected in series circuit, a potential source connected across said series circuit and providing a sufficiently high potential across said members when said members are separated to assure the overcoming of contact resistance to current flow upon engagement of the members to provide an input signal for the amplifying means to change the output of said amplifying means to actuate said control means upon engagement of said members, said resistance having a magnitude limiting the current flow in said series circuit to a magnitude incapable of producing a substantially noticeable shock in the human body, and means biasing said amplifying means to provide a quiescent output current in said output circuit when said members are separated comprising circuit means connected to provide a feedback voltage from a portion of said output circuit which feedback voltage varies with the current in the output circuit, said circuit means including connections degeneratively applying the derived feedback voltage to the input of the amplifying means to tend to maintain a substantially constant quiescent current in said output circuit for variations in the power supply voltage for said amplifying means.

2. In a printing press or similar machine for performing an operation on a material and including means for delivering the material to a predetermined position and sensing means for determining whether the material has been delivered to said position; the combination comprising two conductive members having a first relative position in engagement with each other and a second relative position spaced from each other, said members obtaining said second relative position when the material is properly delivered and the said first relative position when improperly delivered, a control circuit including electronic amplifying means having an input circuit and an output circuit, said output circuit including a relay coil for effecting a control operation when energized by a current of a predetermined magnitude and said input circuit including a resistance connected in series circuit with said members, a potential source connected across said series circuit and providing a potential when said members are separated sufficiently to assure the overcoming of contact resistance to current flow upon engagement of said members and an input signal to said amplifying means upon engagement of said members to effect energization of said relay coil by a current of said magnitude, said resistance limiting the current flow in said series circuit to a magnitude incapable of producing a substantially noticeable shock in the human body, and means biasing said amplifying means to provide a quiescent trickle output current in said output circuit below said predetermined magnitude when said members are separated comprising circuit means connected to derive a feedback voltage from a portion of said output circuit which feedback voltage varies with the current in the output circuit, said circuit means including connections degeneratively applying the derived feedback voltage to the input of the amplifying means to bias said amplifying means to tend to maintain a substantially constant quiescent output current of a magnitude insufficient to actuate said control means.

3. In a printing press or similar machine for performing an operation on a material and including means for delivering the material to a predetermined position and sensing means for determining whether the material has been properly delivered to said position; the combination comprising two conductive members having a first relative position in engagement with each other and a second relative position spaced from each other, said members obtaining said second relative position when the material is properly delivered and said first relative position when improperly delivered, a control circuit for performing a control operation upon the engagement of said members comprising electronic amplifying means having an input circuit and an output circuit including control means actuatable to effect a control operation, a power supply for said electronic amplifying means, said input circuit for said amplifying means comprising said members and a high resistance connected in series circuit with said series circuit being connected across said power supply to have substantially the full voltage of said supply impressed thereacross, the voltage across said members when separated having a magnitude sufficient to break down the resistance to current flow of any normal dirt insulating film on the conductive members and the engagement of said members establishing a current flow in said series circuit providing an input signal for said amplifying means to actuate said control means, said high resistance having a magnitude limiting the current flow in said series circuit to a magnitude incapable of producing a substantially noticeable shock in the human body.

4. In a printing press or similar machine for performing an operation on a material and including means for delivering the material to a predetermined position and

sensing means for determining whether the material has been properly delivered to said position; the combination comprising two conductive members having a first relative position in engagement with each other and a second relative position spaced from each other, said members obtaining said second relative position when the material is properly delivered and said first relative position when improperly delivered, a control circuit including an electronic amplifying means having an output circuit, control means in said output circuit energizable to effect a control operation, a power supply for said amplifying means, an input circuit for said amplifying means comprising said members and a relatively high resistance connected in series across said power supply to provide an input signal for effecting the actuation of said control means upon the engagement of said members, said high resistance having a magnitude limiting the current flow in said series circuit upon engagement of said members to a magnitude incapable of producing a substantially noticeable shock in the human body, and means biasing said amplifying means to provide a quiescent output current in said output circuit of insufficient magnitude to actuate said control means when said members are separated comprising circuit means connected to derive a feedback voltage from a portion of said output circuit which feedback voltage varies with the current in the output circuit, said circuit means including connections degeneratively applying the derived feedback voltage to the input of the amplifying means.

5. In a printing press or similar machine for performing an operation on a material and including means for delivering the material to a predetermined position and sensing means for determining whether the material has been properly delivered to said position; the combination comprising first and second conductive members having

a first relative position in engagement with each other and a second relative position spaced from each other, said members having said second relative position when the material is properly delivered and said first relative position when improperly delivered, a power supply having negative and positive terminals, means grounding said second conductive member and said positive terminal to maintain said second conductive member and said positive terminal at ground potential, amplifying and switching means comprising a grid controlled amplifying tube having an anode and a cathode and first and second connections respectively connecting said anode and said cathode to said positive and negative terminals, a control relay having a relay coil in said second connection energizable to effect a control operation, means connecting the said first member to the grid of said tube, and a current limiting resistance connecting said first member to said negative terminal whereby the voltage drop across said coil biases said grid in a negative manner with respect to said cathode, the circuit parameters of said amplifying means being such that with said members in their second relative position a quiescent trickle current flows in said second connection insufficient to actuate said relay coil, said current limiting resistance being of a magnitude to limit the current flow upon the engagement of said members in the circuit including said members and said resistance to a magnitude incapable of producing a substantially noticeable shock in the human body.

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