

G. WINTRISS

PRESS WITH MECHANICAL MALFUNCTION SIGNAL

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Block diagram of the Malfunction Detector & Automatic Stop for Press (126). The block has four inputs/outputs: a power input (+) and ground (-) labeled 128; a signal input labeled 130, which is connected to a "CYCLIC SIGNAL FROM DRIVE SHAFT"; a signal output labeled 132, which is connected to "TO CLUTCH"; and a ground connection at the bottom.

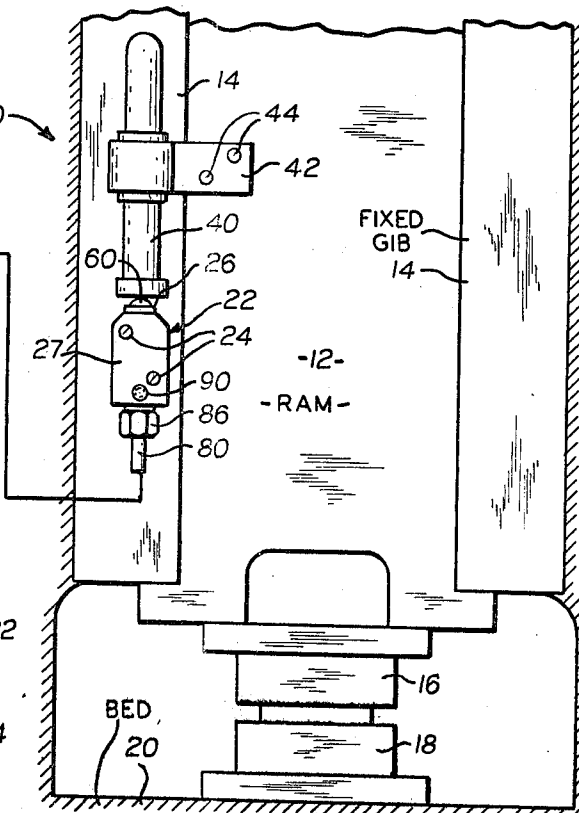


FIG. 3.

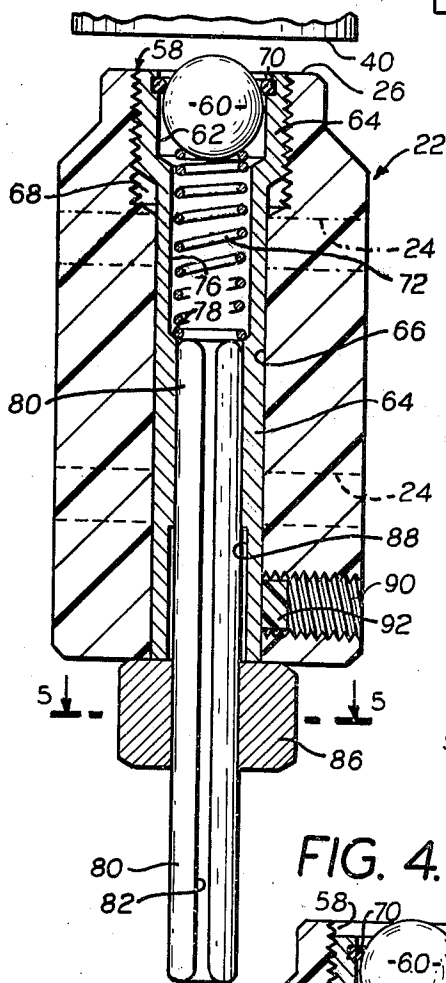


FIG. 2.

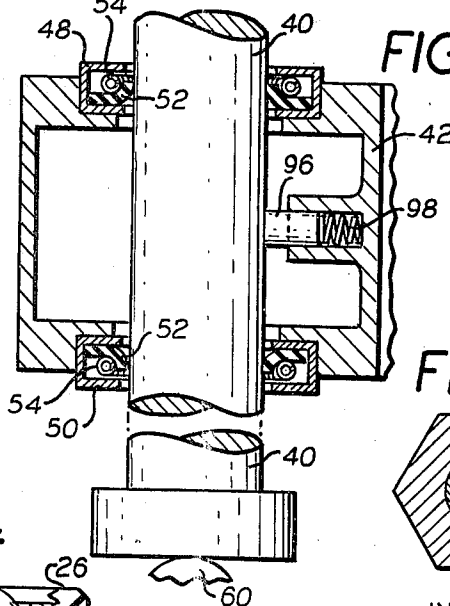
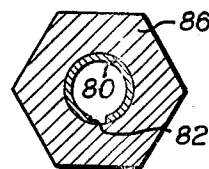


FIG. 5.



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PRESS WITH MECHANICAL MALFUNCTION SIGNAL

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8 Claims

ABSTRACT OF THE DISCLOSURE

A press is equipped with electrical switch means for indicating any shortening of the stroke of the ram of the press, and the switch means are adjustable to change their sensitivity and to compensate for different thicknesses of stock or other changes in the working conditions. A movable switch contact is connected with the ram for movement as a unit with the ram, but the connection is a friction connection that is conveniently movable into an initial zero setting and that protects the press from damage if improperly adjusted. A relatively fixed contact in a housing is connected at a location on a fixed part of the press frame in the path of the movable contact. This relatively fixed switch contact is adjusted to change the sensitivity.

RELATED INVENTIONS

The invention of this specification is related to that shown in my co-pending patent application Ser. No. 697,197 filed Jan. 11, 1968 for Fluid Operated Detector for Reciprocating Parts, and my co-pending patent application Ser. No. 735,769 filed June 10, 1968 for Press With Overload Switch Operator.

The relation to these other applications is in the adjustment of the actuator or part which moves as a unit with a ram of the press and which is connected to the ram by a friction connection.

SUMMARY OF THE INVENTION

This invention has a position sensor including a relatively fixed contact of electric switch means located in a housing on a fixed part of a press or the like. This relatively fixed contact is adjustable to project up through the top surface of the housing by a desired amount which can be adjusted down to a value approaching zero; the adjustment depending upon the desired sensitivity of the malfunction signal.

A movable contact of the switch means moves up and down as a unit with the ram or other part of the press along a course that brings the movable contact into position to touch the relatively fixed contact and the top of the housing of the position sensor when the ram reaches the intended lower limit of its working stroke. The movable contact is connected with the ram of the press by a friction connection that yields as the ram continues to move down after the movable contact has touched the top surface of the housing. The yielding of the friction connection leaves the movable contact with a zero setting at the end of its down stroke so that it repeats its contact with the top of the housing at the lower limit of subsequent down strokes of the ram.

This zero setting is made with no work in the press. The relatively fixed contact is then adjusted to a position to be touched by the movable contact before the ram reaches the end of its stroke; i.e., above the top of the housing and preferably at a distance equal to about one half of the thickness of the stock on which the press is going to work. A double thickness of stock prevents the ram from moving down far enough for the movable contact to touch the relatively fixed contact and this

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failure to make contact at a time in the press cycle where contact should be made causes operation of a malfunction detector. For thinner or thicker stock, the relatively fixed contact is adjusted up or down, respectively, with respect to the top surface of the housing to change the sensitivity of the switch means.

Other objects, features and advantages of the invention will appear or be pointed out as the description proceeds.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing, forming a part thereof, in which like reference characters indicate corresponding parts in all the views:

FIGURE 1 is a diagrammatic view of a press with the apparatus of this invention connected to the press for obtaining malfunction signals;

FIGURE 2 is a greatly enlarged sectional view of the movable contact and its connection with the ram of the press shown in FIGURE 1;

FIGURE 3 is a greatly enlarged sectional view of the relatively fixed contact and its adjusting means shown in FIGURE 1;

FIGURE 4 is a fragmentary sectional view of the upper part of the structure shown in FIGURE 3 and illustrating the way in which the relatively fixed contact is adjusted; and

FIGURE 5 is a sectional view taken on the line 5—5 of FIGURE 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIGURE 1 shows a press having a frame 10 with a ram 12 that moves up and down in stationary gibs 14 to reciprocate a movable die part 16 toward and from a fixed die part 18. The movable die part 16 is rigidly connected to the ram 12 and the fixed die part 18 is connected to a bed 20 of the press.

A position sensor 22 is attached to a fixed part of the frame 10. In the drawing, the sensor 22 is shown attached to one of the gibs 14 by fastening means consisting of screws 24. At the upper end of the sensor 22 there is a top surface or upper face 26 of a housing 27 of the position sensor and this upper face 26 serves as an abutment surface with which a rod 40 comes in contact.

The rod 40 is attached to a movable part of the press 10, and in the construction illustrated, the rod 40 is attached to the ram 12 by a bracket 42 rigidly secured to the ram 12 by screws 44. The rod 40 is held in the bracket 42 by friction, and with the rod 40 extending parallel to the direction of travel of the ram 12 and in substantial axial alignment with the housing 27 of the position sensor 22. When the ram 12 is at the intended limit of its downward stroke, i.e., when the die parts 16 and 18 are in closed relationship with one another, the end face at the lower end of the rod 40 abuts against the upper face 26 of the housing 27.

FIGURE 2 shows the construction by which the rod 40 is frictionally held by the bracket 42. There are two rings 48 and 50 which fit into counterbores in the bracket 42. These rings may fit into the bracket with a press fit, or they may be held in place by fastenings, as desired. The rings 48 and 50 are integral with the bracket 42 and the openings in the rings 48 and 50 are somewhat larger in diameter than the diameter of the rod 40.

In order to hold the rod yieldably against sliding movement through the bracket 42, there is a flexibly stiff washer 52 located in a recess in the inner face of each of the rings 48 and 50. Each of these washers 52 has an inside diameter smaller than the diameter of the rod 40 so that the washer 52 is distorted when the rod is pushed through the opening in the washer.

The washer 52 may have enough resilience to grip the rod 40 with the desired friction grip, but in the construction illustrated, there is a coil spring 54 in the recess of each of the rings 48 and 50; and these springs 54 are under tension and press the distorted inner edges of the washers 52 into firmer friction contact with the cylindrical surface of the rod 40. The inner edge of each washer 52 serves as a friction brake to restrain the rod 40 against axial movement with respect to the bracket 42.

In the illustrated construction, one of the washers 52 is distorted upwardly and the other is distorted downwardly so that one or the other of them offers its maximum resistance to movement in the opposite direction to the other. However, the friction of the washer 52 on the rod 40 is not sufficient to prevent the rod from moving with respect to the bracket 42 when subjected to a substantial end thrust by manual force of the operator of the machine, or to prevent the bracket 42 from moving along the rod 40 when the rod 40 is in contact with the upper face 26 of the housing 27 and the bracket 42 continues to move downward with the ram of the press.

The springs 54 are merely representative of means for thrusting the washers 52 into friction contact with the rod 40; and the washers 52 with their springs 54 are representative of a bearing for the rod and yieldable friction means for holding the rod 40 in any desired set position with respect to the bracket 42.

In the operation of the invention, the operator makes a "zero" adjustment by moving the press until the ram is toward the lower end of its stroke, and he then forces the rod 40 downward until the lower end face of the rod abuts against the upper face 26 of the housing 27. The ram is then moved downwardly to the lower end of its stroke, with no work between the die parts 16 and 18, and this advances the bracket 42 along the rod 40 until the ram passes lower dead center. As the ram starts moving upward, the rod 40 moves upward as a unit with it; and the rod is now in an adjusted position where it will abut against the upper face 26 of the housing 27 on each repetition of the down stroke of the ram.

FIGURE 3 shows the construction of the housing 27 which is made of electrical insulating material. There is a center opening 58 through the upper face 26. A relatively fixed electrical contact comprising a ball 60 projects through the opening 58 and this relatively fixed contact is in the path of the rod 40 and in position to be touched just before the rod abuts against the upper face 26.

The ball 60 is freely supported in a recess 62 in the top of a holder 64 which extends through a passage 66. The center opening 58 is at the top of a counterbore 68 of the passage 66. The counterbore 68 is threaded and there are corresponding threads on the holder 64 which fit the threads in the counterbore 68. Thus rotation of the holder 64 about the axis of the passage 66 causes the holder 64 to screw up and down along the threads in the counterbore 68, and this moves the ball 60 up and down with respect to the housing 27 and changes the extent to which the ball 60 projects above the plane of the upper face 26 of the housing.

The ball 60 is prevented from coming out of the recess 62 by a snap ring 70 located in a circumferential groove in a wall of the recess 62. A helical compression spring 72 holds the ball 60 up against the snap ring 70 which serves as a stop for positioning the ball 60 with respect to the holder 64.

When the rod 40 touches the ball 60, the circuit of the switch means is closed. The rod 40 is the movable contact of the switch means and the ball 60 is the relatively fixed contact; but for practical purposes, it is necessary to allow for some over-travel after the switch contacts come together, and for this reason, the ball 60 is held against the snap ring stop 70 by yielding means consisting of the spring 72.

The spring 72 extends downwardly through an open-

ing 76 in the bottom of the recess 62 to a shoulder 78. A split pin 80 extends upwardly through the opening 76 to the shoulder 78 and co-operates with the shoulder 78 in holding the lower end of the spring 72 in centered position.

The split pin 80 is a piece of tubing made of elastic material and having an open longitudinal seam 82. The undistorted diameter of the split pin 80 is larger than the diameter of the opening 76 so that the split pin 80 is under some transverse compression when inserted into the passage 76. This provides substantial friction between the split pin 80 and the holder 64 so that rotation of the split pin 80 causes corresponding rotation of the holder 64 and movement of the holder up and down in the threads of the counterbore 68 for adjusting the elevation of the relatively fixed contact ball 60, as previously explained.

The split pin 80 extends for a substantial distance below the bottom of the housing 27 and there is a knob or nut 86 on the split pin 80 for rotating the split pin by hand or by means of a tool. The connection between the knob 86 and the split pin 80 is a friction connection obtained by having the opening through the knob 86 of a diameter smaller than the undistorted diameter of the split pin 80 so as to compress the split pin transversely to obtain a friction connection similar to that between the split pin 80 and the holder 64, as already explained. A counterbore 88 at the lower end of the opening 76 prevents the opening 76 from exerting a compressive force against the split pin 80 in the region of the knob 86 and thus increases the pressure of the split pin against the inside of the knob 86 to obtain adequate friction.

A set screw 90 with a clamping pad 92 threads through an opening in the side of the housing 27 and into contact with the holder 64 for locking the holder securely in any adjusted position. This set screw 90 is released before the knob 86 is turned to adjust the contact ball 60; but if the operator forgets to release the set screw 90, no harm can be done because the knob 86 will slip on the pin 80, or the pin 80 slip in the holder 64, before any damage is done to the assembly.

FIGURE 3 shows the ball 60 adjusted to its uppermost position. Any further rise in the ball holder 64 would project the upper end of the ball holder above the upper abutment face 26 of the housing 27 and thus interfere with the zero adjustment of the rod 40. The knob 86 contacts with the bottom of the housing 27 when the ball contact 60 is at its upper limit to indicate that the upward adjustment has reached its limit.

FIGURE 4 shows the holder 64 adjusted downward so that the ball 60 is at a lower level with respect to the upper abutment face 26 of the housing 27. This lowering of the ball 60 requires that the ram and rod 40 travel downward nearer to the original zero adjustment in order to close the circuit between the rod 40 and the ball 60. A smaller variation in the stroke of the ram would, therefore, leave the switch open when adjusted as in FIGURE 4 as compared with the adjustment shown in FIGURE 3. In practice, it is advisable to adjust the ball 60 so that it projects above the top of the upper face 26 by a distance equal to one half the thickness of the stock on which the ram is working. This provides for minor variations during normal operation; but a failure to strip with a resulting double thickness of stock in the die is immediately detected since the rod 40 can not move down far enough to touch the contact ball of the position sensor.

The circuit controlled by the rod 40 as the movable contact and the ball 60 as the relatively fixed contact is preferably a low potential circuit. In the preferred construction, the rod 40 is at the potential of the frame of the press and touching of the switch contacts grounds their circuit on the press frame. Since the washers 52 (FIGURE 2) that hold the rod 40 are often made of rubber or other electrical insulating material, the rod 40 would be electrically insulated from the frame of the press. It is desirable, therefore, to have a brush 96 on

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the bracket 42 and urged against the rod 40 by a spring 98 so that the rod 42 is grounded on the bracket 42 which is, in turn, grounded on the frame of the press.

Although the switch means and the apparatus for operating it, as described in this specification, can be used in various control systems, it is especially adapted for use in a two-pulse system, as illustrated diagrammatically in FIGURE 1.

A controller 126 is supplied with power from a power line 128 and it is supplied with a cyclic signal through another circuit 130 which is operated to produce a signal pulse which starts before the ram reaches the bottom of its stroke and which persists until after the ram has started back in its return stroke. This signal pulse may be referred to as the "cyclic" signal and it can be obtained from a commutator or other switch on the flywheel or any cyclically moving part of the press. The signal is produced regardless of whether or not the press is functioning properly.

In a usual type of control of this nature, the cyclic signal conditions the controller to stop the press before it completes another cycle by shutting off power to the motor or by disengaging a clutch, the latter being preferred since it involves less inertia to be overcome in effecting a stop. A circuit for disengaging a clutch is indicated by the reference character 132 in FIGURE 1.

The signal from the position sensor 22 produced by the coming together of the rod 40 and the ball 60 is a pulse that cancels the conditioning pulse which would stop the press on the next stroke. Unless this pulse from the position sensor reaches the controller 126 during the persistence of the cyclic signal from the circuit 130, the operation of the press stops.

Instead of operating a controller, such as the controller 126, it will be understood that the switch means of this invention can be used to merely operate a signal indicating malfunction, but on high-speed presses, automatic controls are to be preferred because a signal may be given when an attendant is not watching, or considerable damage may be done before the attendant has time to stop the operation when doing so manually.

The preferred embodiment of the invention has been illustrated and described, but changes and modifications can be made and some features can be used in different combinations without departing from the invention as defined in the claims.

What is claimed is:

1. Apparatus including mechanically operated switch means for detecting malfunction of a press or the like which has a frame and a ram movable toward and from a bed of the press with each stroke of the press, the switch means including a movable contact, a friction connection between the movable contact and the ram movable as a unit with the ram, a position sensor including a housing at a fixed location on the frame, and a relatively fixed contact carried by the housing in the path of movement of the movable contact, means for adjusting said relatively fixed contact with respect to the housing toward and from the movable contact to change the sensitivity of the switch means to make electrical contact in response to different variations in the position of the ram at the end of a working stroke.

2. The apparatus described in claim 1 characterized by

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a yieldable support for the relatively fixed contact on the housing whereby the contacts can have over-travel after they come together.

3. The apparatus described in claim 1 characterized by the housing being in the path of movement of the movable contact, and a part of the movable contact being in position to abut against a surface of the housing for a zero adjustment of the movable contact when the ram is at the bottom of its stroke, and the relatively fixed contact being in the path of an area of the movable contact other than the part that abuts against the housing.

4. The apparatus described in claim 1 characterized by the part of the housing with which the movable contact abuts being made of electrical insulating material, and the housing having an opening through which the contacts have access to one another.

5. The apparatus described in claim 4 characterized by the relatively fixed contact being a ball that projects through the opening in the housing, a holder for the ball, a stop on the holder limiting the movement of the ball toward the movable contact, and means for moving the holder up and down in the housing to adjust the ball up and down with respect to the housing and parallel to the direction of movement of the ram.

6. The apparatus described in claim 5 characterized by a spring for holding the ball against the stop and the means for moving the holder up and down being screw threads on the holder that screw into complementary screw threads in the housing, means extending below the end of the housing for rotating the holder and for maintaining it in adjusted position, said means including a knob for manual operation.

7. The apparatus described in claim 2 characterized by the yieldable support being a spring, a holder in which the relatively fixed contact is held, said holder having a stop against which the relatively fixed contact is held by said spring, the holder being made of electrical conducting material and the housing being an electrical insulator, and an electric circuit of which the contacts are a part, the frame of the press being a part of the circuit and the movable contact being at the potential of the ram.

8. The apparatus described in claim 1 characterized by the movable contact being a rod, the friction connection of the rod to the ram including a bracket connected with the ram, and a bearing in the bracket in which the rod is held with a friction grip and in which the rod is longitudinally movable to contact with the housing and the relatively fixed contact, and a brush connected with the bracket and completing a circuit from the bracket to the rod whereby the bearing can be made of electrical insulating material without interrupting continuity of the switch circuit.

References Cited

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