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(54) **Monitoring press forces electrically**

(57) A method of monitoring power presses for detecting malfunction which includes obtaining an amplified signal from a strain responsive device fitted to the press and digitising the peak

value of the signal for comparison with known acceptable peak value signal levels; the output of the amplifier being automatically zeroed when the press is not under strain to compensate for variations due to temperature changes and gauge hardening.

FIG. 1

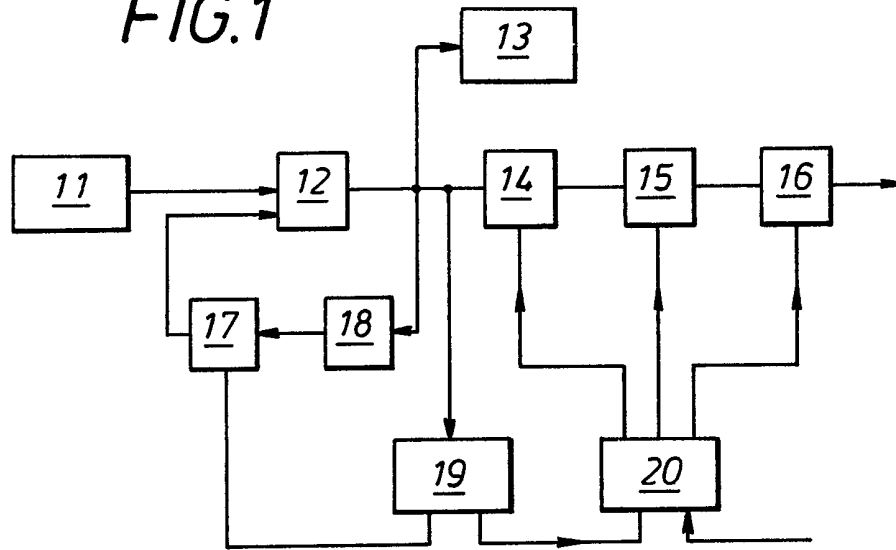
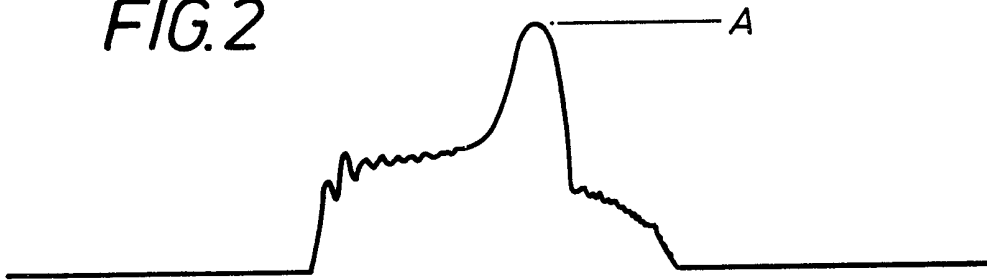


FIG. 2



SPECIFICATION

Method of monitoring the operation of a power press

This invention relates to a method of monitoring the operation of a power press during operation, and includes both means for monitoring power presses and power presses that include such means.

According to the invention a method of monitoring the operation of a power press during operation includes:—

- a) fitting a strain responsive signal generating device to a member of the press that is subject to strain during operation of the press;
- b) amplifying the signal generated by the device and calibrating the amplified signal such that it represents the press loads during operation;
- c) storing the peak value of the amplified signal for each press cycle;
- d) digitising the peak value after detecting that the pressing operation is complete;
- e) feeding the digital value to a visual display or recording/monitoring system; and
- f) zeroing the output of the amplifier with the press not under strain to compensate for gauge hardening, temperature changes and any other long term system variation.

Thus the invention provides an accurate means for monitoring press loads during operation which can be utilised not only to reduce the peak press loads to a value necessary to produce a satisfactory product but also to detect any malfunction of the dies, two blanks being pressed or any other fault that causes variations in the press load to occur.

In practice several strain responsive signal generating devices may be employed on each press and each strain responsive signal generating device may comprise a strain gauge bridge network; and the devices may be attached to convenient parts on the press structure such as the frame and press connecting rods.

The signal from the strain responsive device may be calibrated using a load cell or from known press data.

The invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a block diagram of a press monitoring arrangement according to the invention; and

Figure 2 is an example of a typical trace obtained during press operation.

Referring to Figure 1, strain gauge bridge networks 11 are fitted to members of a press that are subject to strain during operation such as the connecting rods and/or to other parts of a power press (not shown), and the signals derived therefrom are fed to a pre-set gain sensing amplifier 12 which has the gain set by reference to a load cell or known press data such that the amplifier output represents the actual instantaneous press load.

The output of the amplifier is fed to a suitable

recorder 13 and to a peak hold circuit 14 whose output signal is proportional to the peak press load. A timing control logic circuit 20 triggered by either a predetermined strain level fed from a press stroke detector 19, or by a suitable signal derived from switching device (not shown) activated by rotation of the press at the appropriate time during the press cycle, resets circuit 14 and initiates sequential operation of the circuits 15 and 16 as follows; the output signal of the circuit 14 is digitised in the analogue to digital converter 15 and fed in a serial or parallel via a necessary output buffer circuit 16 to a monitoring system (not shown) such as a visual display unit, programmable controller or a mini-computer; the peak hold circuit and timing control circuit being reset by the monitoring system after receipt of data.

The amplifier 12 is provided with a closed loop stabilizer feedback circuit consisting of an integrator 17 and error detection circuit 18 for automatically zeroing the output of the amplifier with the press under no strain. During press operation with the press stroke detector 19 detecting press strain above the predetermined strain level the integrator circuit 17 is suppressed by a signal from the detector to prevent self compensation action of the stabilizer circuit taking place.

Figure 2 illustrates a typical trace of press load plotted against time during a single operation of the press. The peak load is indicated by the letter 'A', and it has been found that such a trace is consistently produced during normal operation.

Thus the digital value of the peak load when fed to a visual display unit, or to a recording/monitoring system allows,

- a) the press to be set up efficiently without excessive loads being produced,
- b) a true stamping count to be made without free runs, which produce a reduced peak load, being recorded, and
- c) a safety cut out to be actuated if the load becomes excessive during operation.

CLAIMS

1. A method of monitoring the operation of a power press during operation which includes:—
 - a) fitting a strain responsive signal generating device to a member of the press that is subject to strain during operation of the press;
 - b) amplifying the signal generated by the device and calibrating the amplified signal such that it represents the press loads during operation;
 - c) storing the peak value of the amplified signal for each press cycle;
 - d) digitising the peak value after detecting that the pressing operation is complete;
 - e) feeding the digital value to a visual display or recording/monitoring system; and
 - f) zeroing the output of the amplifier with the press not under strain to compensate for gauge hardening, temperature changes and any other long term system variation.
2. A method of monitoring the operations of a

power press substantially as hereinbefore
described with reference to the drawing.
3. A power press including monitoring means

5 adapted to monitor the operation of the press in
accordance with the method claimed in any one of
the preceding claims.