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Curtiss et al.

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[54] MEANS DETECTING NON-REBAILED PRINT HAMMERS TO RECYCLE THE BAILING MEANS

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[58] Field of Search.....101/93 C, 96; 235/58 P, 60 P, 235/132, 128, 98, 144; 197/47, 107, 187, 192

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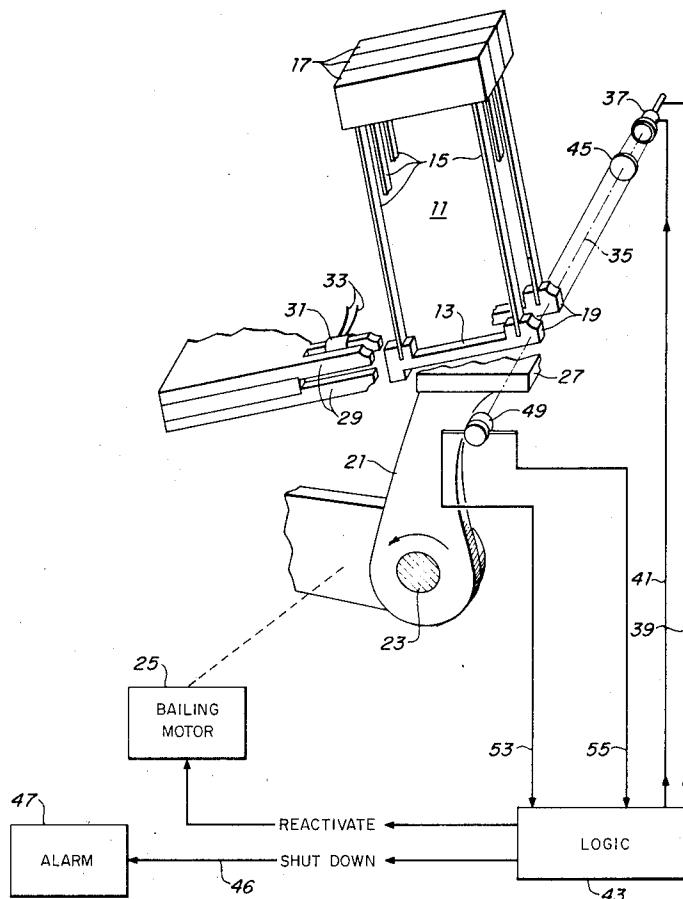
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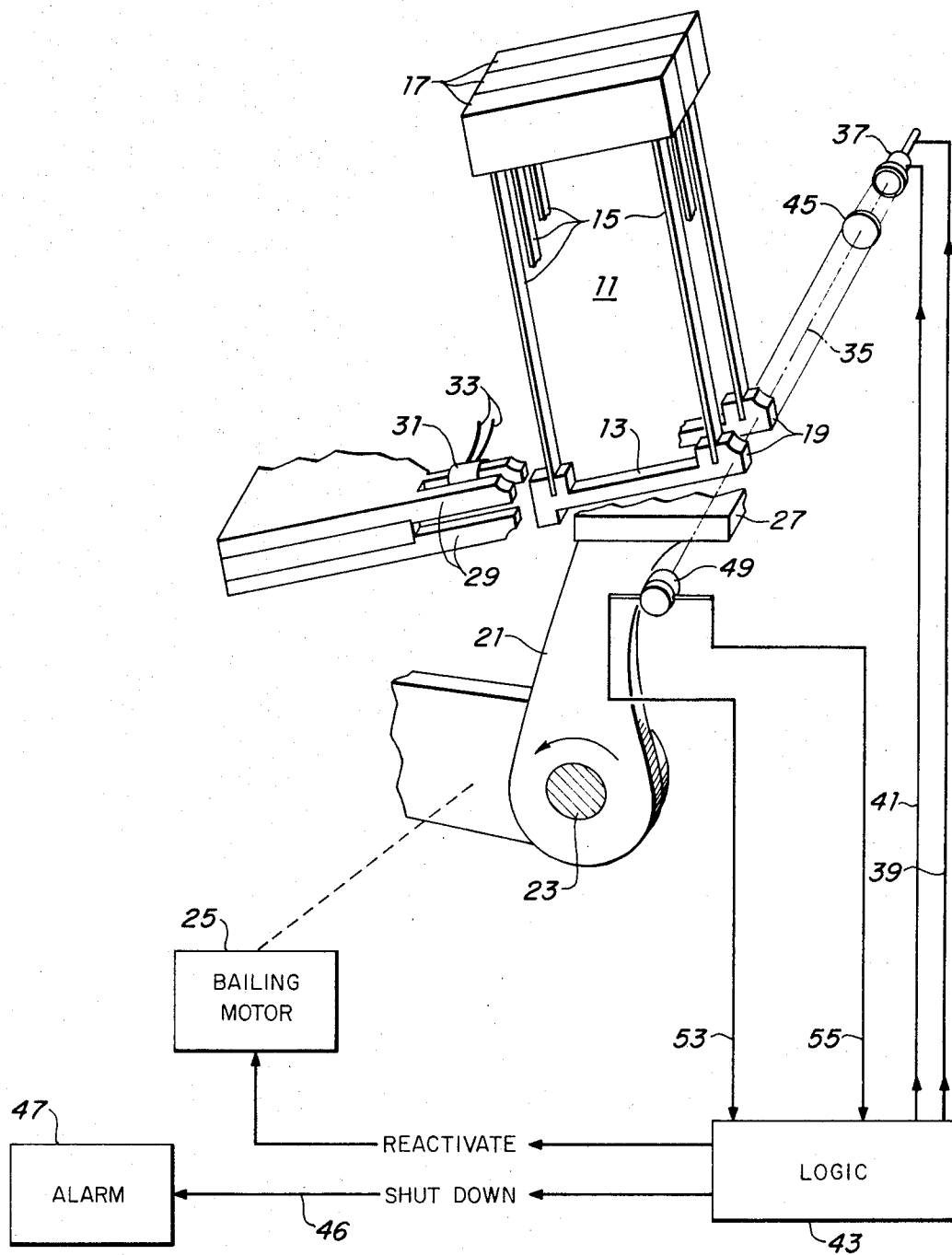
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[57] ABSTRACT

A printer is disclosed having a number of hammers aligned along a transverse axis which hammers are in a cocked position awaiting a print signal, means for simultaneously bailing all hammers not in the cocked position into such position and electrooptical means having an optical axis parallel with the transverse axis of the hammers for detecting if any one or more of the hammers have not been cocked.

9 Claims, 1 Drawing Figure





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MEANS DETECTING NON-REBAILED PRINT HAMMERS TO RECYCLE THE BAILING MEANS

FIELD OF INVENTION

This invention relates to printers having means to detect hammers which have not been properly positioned and more particularly to such printers having means to properly position hammers so improperly positioned upon detection of such condition.

BACKGROUND OF INVENTION

High speed printers require hammers which must be actuated at the precise time that type is moving into the print position. In order to assure proper actuation, the hammer must be positioned so that it may receive the full driving force and impact the paper with proper velocity at the proper time.

Commonly, hammers are driven by electromagnetic means. To reduce the power necessary to drive the hammers, some printers employ hammers which are mechanically bailed and held in the cocked position obtaining the drive force by springs which are under tension when the hammers are cocked. When the hammers are released the stored energy in the cocked spring either aids the electromagnetic drive or has sufficient energy in itself to drive the hammers to impact. In any case it is important that the hammers be precisely positioned prior to application of drive or release pulses.

No apparatus or method exists in the prior art for detecting that hammers are improperly positioned.

SUMMARY OF INVENTION

It is an object of this invention to provide a printer which assures that print hammers are properly positioned before they are driven to impact the print medium.

It is a further object of this invention to provide a printer which assures that no data is lost due to improper hammer positioning.

It is a further object of this invention to provide a printer which assures that drive forces are properly applied to the hammers so that misregistration smudging or multiple impact of the printer characters does not occur.

It is a further object of this invention to provide such a printer utilizing a fail safe system.

The invention may be accomplished by optical detecting apparatus positioned along the line of print hammers just forward of the hammer faces when in their preprint position. If radiation from an emitting source is blocked by a hammer and not received at the other end of the line of hammers one or more hammers are improperly positioned.

DISCLOSURE OF PREFERRED EMBODIMENT

Other objects, features and advantages will occur from the following description of a preferred embodiment and the accompanying drawing, which is an isometric cutaway view of the optical and mechanical portions of the invention and a block diagram of the electrical portions of the invention.

Each hammer 11 contains an arm 13 supported by two reed springs 15 in a suitable base or frame 17. A flat striking face 19 impacts one of: the print medium; ribbon; or type carrier (not shown), compressing them together to cause printing.

The hammers 11 are shown in a rest position. A bailing arm 21 is driven counter-clockwise about shaft 23 by bailing motor 25 to cause bail bar 27 which extends the length of all the arms 13 to contact the bottom surface of arms 13 to push them against magnetic pole pieces 29. The hammers are held in the cocked position by the magnetic field emanating from pole pieces 29. Bailing bar 27 is returned to the position shown. When printing is required, coil 31 on pole piece 29 receives a pulse of electrical energy over leads 33 sufficient to counteract the holding force of the pole piece 29 and the hammer is released from the cocked position to an impact or print position forward of the rest position shown. The released hammer arm 13 rebounds from the print position, is suitably damped

by means (not shown) and returns to the rest position. After a print cycle is completed, hammers that are released during that cycle are rebailed.

During the bailing process some hammers may not be cocked. To assure that all hammers are cocked, an electro-optical system is placed along an optical axis 35 parallel to the transverse axis of the hammers 11 just forward of the location of striking faces 19 when the arms 13 are in the cocked position. The electro-optical system includes a light emitting diode 37 having a lead 39 from its anode and a lead 41 from its cathode connected to the printer logic circuitry 43, a collimating lens 45 is placed proximate to the diode 37 and a photosensitive transistor 49 having emitter and collector leads, 53 and 55, connected to the logic circuitry 43, is placed at the other end of the line of hammer arms 13. In the position shown hammer arms are not in the cocked position and radiation emitting from the diode 37 and passing through lens 45, is blocked by a portion of hammer arm 13. If all arms 13 are properly cocked, radiation from diode 37 impinges upon the base of the transistor 49. The diode 37 is activated by a short pulse immediately following completion of each bailing cycle. If radiation is received by transistor 49, a signal is transmitted to logic 43 and the printer is free to enter the next phase of operation. If, however, the transistor 49 does not receive radiation during this interval either (a) one or more hammer arms 13 are not in the cocked position or (b) one of the diode 37, transistor 49 or logic 43 has failed. In any of the foregoing, the effect is one produced by no signal received by logic 43. If any of these conditions occur, the logic 43 reactivates the bailing motor 25 to cock these hammer arms 13 which are blocking the transmitted light. Following the completion of the rebailing cycle, the diode 37 is again pulsed to determine if all hammers are in the cocked position. The rebailing cycle may continue N times where N is any positive integer between zero and a high value dependent upon the particular logic 43 employed. Following the last ineffective bailing cycle the logic 43 emits a signal over lead 46 to an alarm 47 which notifies an operator that a failure exists. The signal over lead 46 also shuts down the printer, awaiting attention from an operator. Shut down is generally not a complete loss of power since any data stored in the printer might be lost if all power were removed, but merely a cessation of printing. The logic 43 may consist of any suitable response mechanism for accomplishing the foregoing functions. For example, the logic may comprise a plurality of relays which will respond to the radiation signal for activating the bailing motor 25 and the alarm 47, as well as energizing the diode 37 in response to the end of a bailing cycle. Other modes of operation will be apparent to those skilled in the art, and the actual construction of such logic is not part of the invention.

It should be noted that shut down may occur after the initial bailing cycle or after any number of rebailing cycles.

The electro-optical system is only activated for a short period following a bailing or rebailing cycle. Therefore the life of the system is enhanced. The system is a fail safe system since any failure in the electro-optical system will cause the lack of a proper signal to logic 43 and will cause the alarm 47 to be activated.

Typical elements that may be used in the electro-optical system are: Gallium Arsenide High Efficiency Emitting Diode available from the Radio Corporation of America, identification number 40736R, which diode emits infra-red radiation; Double Convex Lens available from Edmund Scientific Co.; and NPN Silicon Photo Transistor available from Motorola Corporation, identification number MRD 450.

Although the invention has been described in an embodiment with hammers having a rest, cocked and impact position, the invention is equally applicable to any printer where the hammers must be in a particular position prior to impact.

Other embodiments will occur to those skilled in the art and are within the following claims:

What is claimed is:

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1 A printer having a print cycle and a bailing cycle, comprising a plurality of print hammers each individually actuatable during a print cycle from a first to a second position for printing, repositioning means engageable with each of said hammers for repositioning said hammers from said second position to said first position during a bailing cycle, optical generating means providing an optical beam along an optical path along an axis intersecting a print hammer in said second position, detecting means positioned in said axis for detecting an absence of said optical beam after a bailing cycle indicating a hammer present in said second position after a bailing cycle and means responsive to the detection by said detecting means of said absence of said beam for reactivating said repositioning means.

2. The printer of claim 1 wherein said detecting means is coupled to means for deactivating said printer if any one of said hammers is not in said first position after a bailing cycle.

3 The printer of claim 2 wherein said detecting means is coupled to means for reactivating said means for repositioning if any one of said hammers is not in said first position after a bailing cycle and said detecting means is coupled to said deac-

tivating means for deactivating said printer after said moving means has been reactivated N times, where N is any positive integer.

4. The printer of claim 7 wherein said optical generating means includes a source of radiation and said detecting means an electro-optical transducer to receive said radiation whereby said radiation is blocked by at least one of said hammers which is not in said first position.

5. The printer of claim 4 wherein a collimating lens is placed along said optical path between said source and said transducer proximate to said source.

6. The device of claim 5 wherein said source of radiation is a light emitting diode and said transducer is a photo cell.

7. The printer of claim 10 wherein said optical generating means is momentarily gated on after activation and reactivation of said means for repositioning.

8. The printer of claim 7 wherein said first position of said hammers is a cocked position.

9. The printer of claim 8 wherein said second position is a rest position.

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